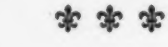
THIS MONTH'S COVER

The scene chosen for our cover this month is quite a common sight in a steel mill. The picture shows how the molten metal is poured into ingot molds.

Photo by Publishers' Photo Service, New York.



SOME DATES FOR YOUR CALENDAR

Michigan Industrial Education Society on March 19–21 at Detroit, Mich.

Eastern Arts Association Convention on April 8–11 at Atlantic City, N. J.

Western Arts Association Convention on April 28, 29, 30, and May 1 at Louisville, Ky.

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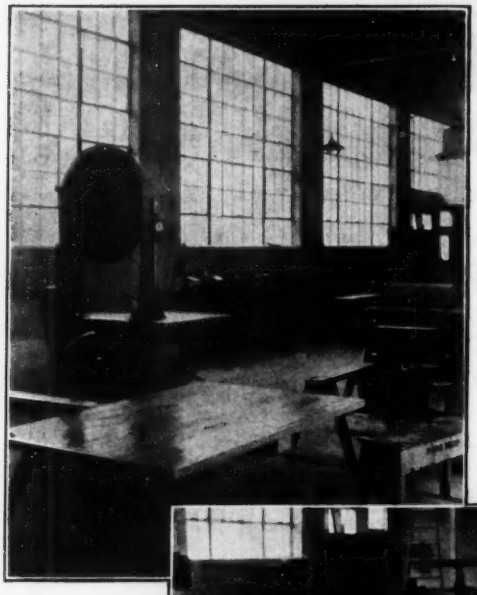

"NEW MACHINES EVEN BETTER THAN THE OLD"

Says IRA N. CROSE
Head of Voc. Arts Dept.
Lodi Union High School

Two views of the manual training department of the Lodi Union High School of Lodi, California. Note in the upper illustration the new Y-36 High Speed Band Saw and No. 12 Speed Lathe. In the lower illustration is shown the B-4 Single Surfacer and No. 1 Variety Saw Bench.

Mr. Ira N. Crose, Head of Vocational Arts Department, Lodi Union High School, Lodi, California, in writing about the new Yates-American installation in his school says in part:

> "We equipped our manual training shop with Yates-American woodworking machines in 1913 and in the nearly 20 years of their operation by students we found them entirely satisfactory, sturdily built and as near fool-proof as it is possible to build them. These machines proved so satisfactory in fact that we recently replaced them with new more up-to-date models of the same make and **find the new ones even better than the old.**"

The improvements Yates-American constantly is making in its extensive line of industrial woodworking machines proves of tremendous value to schools that are Yates-American equipped—because the school and industrial types are exactly the same in size, capacity, quality, safety, ease of operation and durability. The Lodi Union High School is but another link in the fast growing chain of complete Yates-American school installations. Let us send you illustrated circulars on machines in which you are interested.

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Volume 20 MARCH, 1931 Number 3

Vocational Guidance Connected with Training

*R. T. Craigo**

OUR vocational guidance program functions much like a clinic in a hospital.

We take in the patient, give him a preliminary examination, reject a few obviously incurable, continue the observation and even give preliminary treatment in the clinic; then we pass the patient on to the main hospital for further treatment. This further treatment either kills or cures the patient — in cases of mortality we check to see if the error was in the clinic, the operating room, or in some other phase of the patient's treatment.

The analogy may be carried one step farther. The hospital often receives a patient whose case has already been diagnosed by the family physician; obviously, the information thus available should be considered by the hospital clinic.

At Dunwoody Institute we deal annually with from 1,600 to 1,800 boys and men; probably 75 per cent in person, and 25 per cent by correspondence. Probably 80 per cent, or roughly 1,300 to 1,400, ask for, or need, guidance. The questions asked us vary all the way from "Should I become an electrician or a machinist?" in cases of younger boys, to questions like "I have been an electrician for seven years; would it pay me to go to college and take up electrical engineering?" In all cases there is, of course, considerable additional information given orally or in writing as a basis for guidance.

In general, the guidance work falls into two main subdivisions which we may term *vocational* guidance and *trade* guidance. Thus, for instance, we have the younger boys and some older ones who are deciding between vocations; for example, between commercial or industrial vocations or between professional and industrial vocations. If they have chosen an industrial vocation, they must then decide between trades like those of the electrician or the draftsman. This may rightly be termed vocational guidance.

To illustrate trade guidance: we have the older boys or men, usually with trade experience, who need guidance on the next level. Thus, a printer wishes to specialize in linotype or presswork; or a machinist states that he is uncertain whether to fit himself to become an expert toolmaker or to become a general-shop foreman; or a carpenter, who is confronted with seasonal employment, asks if he can take up drafting and estimating and become a contractor.

Our general procedure is illustrated by the following cases.

Vocational Guidance

A group of twenty boys reports at the school office. They come from different grade schools.

They fill out application cards which are checked for age, previous schooling, and parent's occupation. Information about their age is required, as it bears on entrance requirements. The data about their previous schooling are desirable, because they may be specially adaptable to a certain department which the boy may want to enter. A knowledge of what the parent's occupation is, often helps the school to confirm the boy's choice.

The next step is the intelligence test. We use the Otis Self-Administering Test of Mental Ability — Intermediate Grade. When the applicant rates under 80 or near 80, his parents are notified that according to the entrance test, their boy will not be able to carry the work satisfactorily, but that if they so desire, a trial of 30 to 60 days will be given him.

While awaiting the parents' reply, additional tests are given the boy to determine interest in a trade; knowledge of fundamentals about tools, equipment and materials. For example, an 80 I.Q. boy who does not recognize drawings or actual parts of a dry cell, a doorbell, a telegraph key, or a motor, or a commutator, and who has not had enough interest to read about some of these things, is not good material for

*Assistant Director, Dunwoody Institute, Minneapolis, Minnesota.

our electrical department; nor is a prospective machinist with an 80 I.Q., who cannot measure in eights or sixteenths, ready for our machine-shop course.

In an increasing number of cases, the elementary schools are now listing their student's ratings in I.Q., their history, hobbies, choice of vocations, etc. If this information is obtainable, it is checked with the boy's application card that has been filled out at Dunwoody. This is a great additional help, and facilitates matters very much.

Next, these younger boys, if accepted, are enrolled in our general shop, where during a period of four months they are given training in their selected trade supplemented by work in other related lines. Special attention is given to helping the boy find himself, either to verify his selection, or to help him select another line.

This four months' period may be materially shortened in individual cases.

A brief statistical statement on the general shop follows.

Of the total enrollment 1928–29, 6 per cent proved unfit for grade and industrial work. The total enrollment was 339. Of this number, 40 students changed their objective. This means that the percentage of changes was 11.8 per cent in the year 1928–29. For the year 1927–28 it was 4.5 per cent.

Change of Objective Record

General Shops Department

Student No.	*From*	*To*	*Reason for Change*
1	Auto	Mech. Drafting	Likes drafting better
2	Auto	Electric	Did not like auto mechanics
3	Auto	Electric	Plans to become a wireless operator in the Navy
4	Auto	Highway	Better field
5	Auto	Highway	Better field
6	Auto	Machine	Likes machine better
7	Auto	Machine	Thinks future better
8*	Auto	Sheet Metal	Likes sheet metal better
9	Electric	Auto	Likes work; better progress
10	Electric	Auto	Failed in electric
11	Electric	Auto	Not capable in electric
12	Electric	Auto	Electric too difficult
13	Electric	Auto	Electric too difficult
14	Electric	Auto	Likes auto mechanics better
15	Electric	Auto	Likes auto mechanics better
16	Electric	Auto	Likes auto mechanics better
17	Electric	Auto	Auto mechanics easier for him
18	Electric	Bricklaying	Electric too difficult
19	Electric	Building Const.	Taking up father's work
20	Electric	Mech. Drafting	Likes drafting better
21	Electric	Machine	Thinks he is better fitted
22	Electric	Machine	Does not understand electric
23	Electric	Machine	Better progress, likes better
24	Electric	Machine	Likes machine better
25	Electric	Machine	Machine more interesting and easy
26	Electric	Machine	Likes machine shop better
27	Electric	Machine	Lacks foundation for electric
28*	Electric	Machine	More interest in machine
29	Electric	Printing	Electric course too long
30	Electric	Printing	Can earn money at printing, to continue electric at later date
31	Electric	Sheet Metal	No progress in electric
32	Electric	Sheet Metal	Likes sheet metal better
33	Electric	Sheet Metal	Likes sheet metal better
34	Electric	Sheet Metal	Sheet metal easier for him
35	Machine	Auto	Likes auto better
36	Machine	Auto	Likes auto better
37*	Machine	Auto	Thinks he is better adapted
38	Machine	Highway	Sees better opportunity
39	Printing	Electric	Better for his health
40*	Sheet Metal	Electric	Likes electric better

After the general-shop training, the boys are passed to the other shop departments: Electrical, machine shop, automobile, etc. After a brief tryout period, a check-up is made, and some few are returned to the general shops for further guidance.

To sum up, this method of guidance and training allows for consideration of:

1. Previous history as obtained from previous school records bearing on such considerations as on school performance, hobbies, and parent's occupations.
2. Entrance tests and interviews.
3. Trade tryout and trade training.
4. Readvisement when needed.

Trade Guidance

The larger part of the group needing trade guidance makes preliminary inquiries in writing, thus necessitating a great deal of correspondence.

In most cases these people have a rather definite objective, thus, an automobile mechanic wishes to become an auto electrician; a sheet-metal worker wishes to become a layout man; a country printer wishes to become a linotype operator in the city; a small power-plant operator wants to become an all-round electrician.

In some few cases, these objectives include a change in vocation, such as the farmer who wishes to become a machinist, or the garage mechanic who wants to become a draftsman.

The first step is to get a statement on the applicant's general qualifications, and his trade background.

Secondly, he is asked to state his objective as clearly as possible.

Thirdly, he is quizzed as to his future plans and expectations. His answers disclose whether he has visions of learning a new trade in a month and then expects to get a high wage, or whether he is planning to put in

*Changed objective twice.

Students 1 to 8 inclusive represented 7.9 per cent of auto-mechanics enrollment.

Students 9 to 34 inclusive represented 15.5 per cent of the electrical enrollment.

Students 34 to 38 inclusive represented 13.7 per cent of the machinist enrollment.

sufficient time to acquire the trade skill and trade knowledge needed to really learn his new trade.

After the foregoing have been carefully considered, the applicant is informed what courses will most nearly meet his requirements.

After entering, the progress of these older boys and men is carefully watched, in order that the best possible guidance advice may be given them. Thus, an automobile mechanic in training in the automobile electric department entered with the objective of becoming an aviation mechanic. After careful consideration based on his training progress for the month, he was advised to continue in the automobile field with which he was familiar.

Another automobile mechanic who was in training in the auto electric work with the objective of preparing himself to open his own automobile electric service and accessories shop was advised to continue as a mechanic and not assume the added responsibility of conducting his own business.

A railroad signal electrician who entered Dunwoody to become an all-round electrician, was advised after six weeks' training to secure further training in his own field. He did this and returned to the railroad shops with a promotion.

In some few cases the boy or man returns to his former work convinced that the change in vocation which he desired is after all undesirable. Thus a farmer who has attended school with the objective of learning a trade, may return to the farm, use his machine shop or blacksmith or automobile training on repair, maintenance, and operation of his agricultural machinery, and in this way capitalize on his training. In such cases our training and guidance has served a very useful end.

In many cases men in this group are advised to secure some business training. Thus, a carpenter who comes to us for training as a contractor is often advised to take up a course in bookkeeping in an evening school so as to better look after accounts, money matters, and the like.

Another illustration is the case of a young man who entered the electrical course. He also was advised to prepare himself commercially. To this end, he took up a short business-college course afternoons, in addition to his electrical training forenoons.

Some other good illustrations of connecting guidance with training are furnished by groups of electrical and machine-shop students who show marked interest in drafting and designing. Such special aptitudes may not be discernible until a year or more has been spent in a given trade shop.

Students showing these special aptitudes are carefully studied, and often transferred into departments which they had never considered at the beginning. Eleven such men, for instance, were sent to the Westinghouse Electric Company at Pittsburgh for such special training.

To sum up the general procedure,

1. Get a history of the case.
2. Advise tryout courses in lines which seem best suited to the individual; give careful thought to interest as well as to ability (for example, electrical work usually calls for superior ability in mathematics, and yet many people keenly interested in electricity succeed very well even if deficient in mathematical ability).
3. Follow up cases very carefully for several weeks and often for several months. Be not afraid to readvise when necessary.

The Plan of Procedure

*Verne C. Fryklund**

MANY new controls and devices for the improvement of teaching have evolved during the past decade. None has aroused more interest than the *plan of procedure,* or as it is sometimes called, the *job plan.* The purpose of this article is to define the plan of procedure for those who have regarded it with apprehension, as it is an important instructional control which should be more clearly understood.

Its Purpose

A good philosophy of education demands that each individual be given every opportunity to develop all his potential abilities. One of the greatest of all abilities in the shop, and elsewhere, is to be able to think with a purpose and to reason through a given difficulty. While everyone cannot gain efficiency in this, everyone should be given opportunity to do so, both early in life and early in a given subject.

Every good shop teacher requires the learner to think through his job. The purpose of the plan of procedure is to provide a means by which the teacher may know how well the learner has thought through his job. In mathematics, where the need of problem solving is very evident, it is necessary to rely upon a pencil and a piece of paper as an aid to thinking through the problem. The teacher would have no other way of knowing whether the solution has been hit upon. Trials may be made and paper consigned to the basket, but each time the learner attempts a solution, he is making something analogous to a plan of procedure. It is through the results shown on paper that the teacher determines the learner's probable ability to solve the problem. A control is provided whereby

*Instructor Industrial Education, University of Minnesota, Minneapolis, Minnesota.

the teacher discovers how well the learner can do what he purposes to do. Mistakes may be made and new points of instruction may appear, but the teacher knows what they are and can provide the instruction needed.

The materials of the shop cannot be readily discarded without great cost when mistakes have been made. To reduce this to a minimum the teacher should require that each learner plan the procedure for his job, or reason out the solution for the problem. The only way that this can be done adequately is for the learner to state on paper his proposed plan as far as he can go. He should also indicate what tools and materials are to be used. He should be taught on his first job how to figure material. Planning the procedure is the means by which the teacher discovers what the learner probably knows and can do and what points of instruction are necessary. Of course, the learner will not present any better plan for a job in the shop than he may present for a problem at a like stage in mathematics. It has been found that the thoroughness of the plan varies with the native and acquired ability of the learner. The dull individual is restricted in his ability to think through a job, whereas the brighter individual is more successful.

Discrimination in Terminology

Many shop teachers do not discriminate carefully in using shop terminology with the result that confusion arises in discussing method. One of the more serious of these difficulties is the failure to distinguish between jobs and operations. A job in the shop is a project; it is analogous to a problem in mathematics. It is a completed unit composed of a number of manipulative processes in combination. These processes are called operations. A problem in mathematics, likewise, is composed of a number of processes or operations in combination.

The Status of the Job

The job is necessary at the outset of shop experience but it should be recognized as no more than a vehicle for the application of the basic teaching units. The learner may never again do a similar job but he will again and again find it necessary to repeat the operations in various combinations on other jobs. This should be emphasized and should be strictly adhered to if training is to be successful. A series of unrelated jobs cannot be a course of study any more than a series of unrelated problems in mathematics.

In shop or in mathematics it is the duty of the teacher to teach the operations. They must be taught so well that they may be used in necessary combination in doing other jobs or in solving other problems. It is the learner's responsibility to do the job. It is his responsibility also to plan a procedure for doing the job just as it is his responsibility to solve the problem in mathematics. In either case, he must draw upon past and present experience; he must be held to account for the training gained from these experiences without being told each time it should be used. To tell him would be like telling him each step in the solution of a mathematical problem. Of course, when difficulties arise, the teacher must be there to help and suggest but not to do the job, or to solve the problem.

The Starting Point

In shop there is no reason why problem solving and reasoning cannot begin with the elementary jobs just as in elementary arithmetic. Some degree of problem solving is necessary at every stage of shopwork if intelligent self-direction is to be encouraged. As a rule, past experience provides something from which to draw upon even for the first job. The intelligent learner can list at least one or two steps of the procedure on his first job. The first job is also a highly appropriate place for him to discover that he should read the drawing, that he should make a bill of material, that he should use his arithmetic, and that some common tools are necessary. He should be taught early that planning is an ability which is highly essential for success in the shop. He should also learn early that he is being held to account for what he has learned and that he will be expected to draw upon his accumulating stock of knowledge for each subsequent job. To tell the learner each step that must be taken and to give him a list of the tools and materials he needs for each job is defeating the purpose of good teaching.

Question may arise with respect to the learner's present ability to plan his procedure. It is quite certain that he will never learn if he is not given opportunity to begin. In beginning work, his planning may be crude and elementary but it is a habit and ability that must begin sometime; and there is nothing to indicate that it cannot begin just as early in shop as in other subjects.

Teach How to Plan

During the beginning lessons the teacher should give special attention to planning so that the pupil will learn to plan just as he will learn to perform an operation. The teacher should teach how to plan a procedure just as he teaches how to perform an operation. Ability to plan procedures in the shop is just as important as problem solving in arithmetic; it will improve with each succeeding job and as the work advances.

The plan of procedure is not a job sheet. Making a job sheet is a task for a specialist and not for a learner. It contains general directions for doing a job and it is usually sold commercially. The plan of procedure is a general outline written for the teacher's inspection. It is the means by which the teacher determines how well the learner has thought through a given job. It involves reasoning of the highest type. It is just what anyone who is doing creative work must do before attacking a new job. The lawyer, doctor, engineer, builder, teacher, or the orator, must plan very carefully in advance what is to be done, if what he proposes to do is to be a success. It is true, of course, that the more thoroughly and extensively past experience has been gained the more thoroughly and quickly the plan will be made. Planning is necessary nevertheless.

It is also true that pencil and paper are not always necessary. But in teaching they are necessary as a control. It is not always possible to depend upon the learner's say-so, and a written form enables the teacher to check up on the learner's planning.

In Trade Training

The planning of procedures is necessary in trade training as well as in industrial-arts training. A skilled workman in order to progress far in a trade must be able to attack a new job with thought and expedience. While he need not write his procedure while on the job, he must form judgments based upon past experience or he will be of little value to his employer. Making the written plan in training is merely a means by which the instructor checks the learner in his planning. As ability is gained in advanced training, the learner need do less and less of his planning on paper.

Short-term training in automatic machine work must not be confused with training in the whole trade. Little reasoning and planning is necessary in automatic machine work. The work is not creative and will never become so. The ultimate is the automaton. The teacher teaches as quickly as possible what is to be done step by step. The learner must develop a high degree of skill as quickly as possible. Essentially it is training in one operation only.

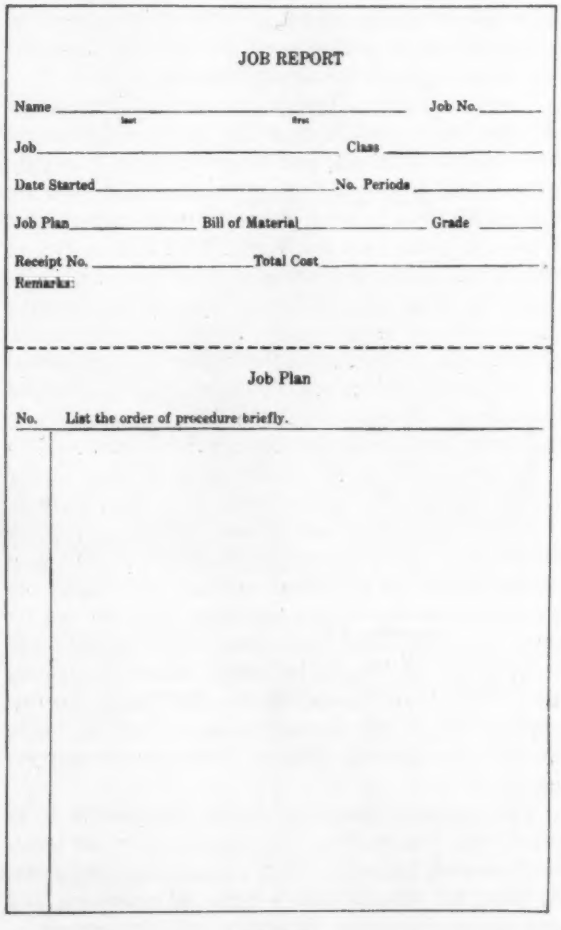
Planning Not a Substitute for Instruction

Planning does not eliminate instruction on operations. On the contrary, it tends to develop the learner's state of readiness for instruction on new operations. New operations must be taught in shop just as new operations must be taught in mathematics. The form of instruction may be oral or it may be written. The use of both increases the possibility of learning. The greater the number of agencies of instruction in a given subject the greater the opportunity for coping with individual differences. It is the teacher's business to see that all necessary instructions are available and in a form that is readily understood.

The teacher must always teach the new operations but the learner must plan the procedure for the job to the extent that his ability and training permit.

A Suggested Method

A learner might describe orally to the teacher how he proposes to proceed on a job but this would be difficult in a large class. It might also be written on the learner's note paper. A more satisfactory method is to use mimeographed or printed forms, as shown in Figure 1. It has been found by those who use them that they are more satisfactory for filing and recording. The place for the material bill should be arranged so that it can be torn off by the teacher and filed separately


JOB REPORT

Name _____ Job No. _____
last first

Job _____ Class _____

Date Started _____ No. Periods _____

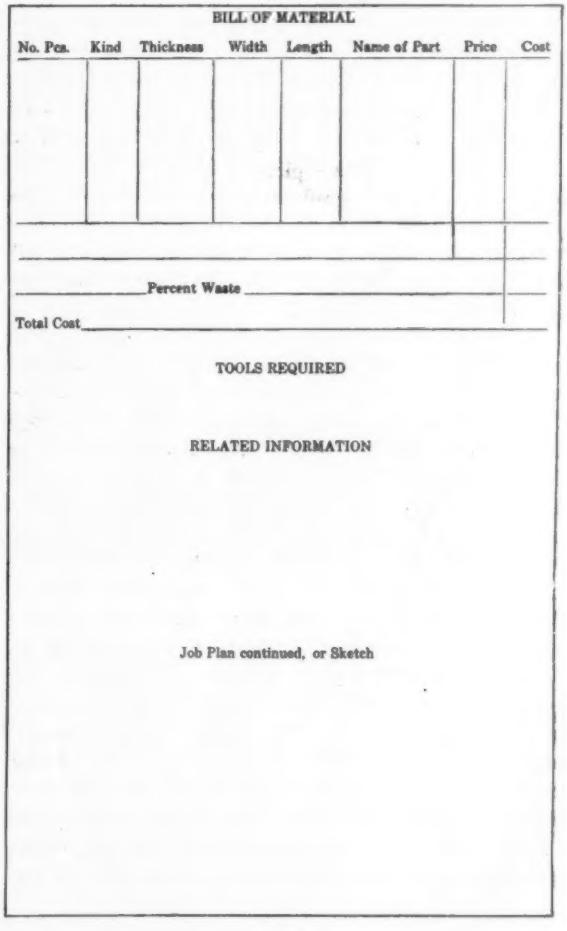
Job Plan _____ Bill of Material _____ Grade _____

Receipt No. _____ Total Cost _____

Remarks:

Job Plan

No. List the order of procedure briefly.


BILL OF MATERIAL

No. Pcs.	Kind	Thickness	Width	Length	Name of Part	Price	Cost
					Percent Waste		
					Total Cost		

TOOLS REQUIRED

RELATED INFORMATION

Job Plan continued, or Sketch

FRONT BACK

FIG. 1. JOB REPORT CARD. ORIGINAL SIZE 6 BY 10 IN.

for material accounting. The remainder of the card can be left in the learner's hands for reference on the job. The form shown is typical of a number now in use.

Summary

Planning a procedure is the means by which the teacher determines how well the learner has thought through his job. It is an important instructional control necessary in all kinds of shop training where intelligent self-direction is desired. It is not a job sheet.

During the beginning lessons the teacher should give special attention to planning so that the learner may start to plan early and develop the habit of planning. There is nothing to indicate that it cannot begin early in the course. It is not a substitute for instruction but it clarifies it. It enables the teacher to determine more readily the points of instruction, and the learner, in turn, meets a situation that sets up a need and desire to learn.

Pencil Rendering in Architectural Drawing

*Harvey W. Waffle**

CAN an architectural-drawing course be organized to cover two years of work and still be profitable as a high-school course? Drawing courses are arranged on a semester basis with one semester given to the study of architectural details and the development of technique, and the other semester devoted to the study of house planning. If this course is given either as a *trade-finding* course, or from the vocational point of view, the student has not as yet been given an *overview* of architectural drawing as a profession, nor has he been given the training to fit him for the profession.

After a student has gone through the procedure of developing the complete plans for a house, what is there left for an advanced course except to repeat the house planning and detailing? Of course a new type of house may be drawn, materials may be changed, and the problem can be made more complicated, but can that time be profitably spent in the average two-year architectural-drawing course?

To overcome this repetition in the course of study it is advisable to begin a study of house plans and house styles as a unit course in the advanced class. Student participation in the study can best be secured through the medium of the pencil sketch, and in so doing the student's knowledge of architecture and his power of observation and retention is developed. He is forced to observe in order to sketch at all and in the process he unconsciously assimilates not only the knowledge of the building drawn, but also a sense of the relative proportions and shapes applicable to original problems of design. The more of these sketches he makes, the greater will be his power to visualize the appearance of a proposed building long before a study on paper has been made. The architect finds a knowledge of free-hand perspective sketching of great value in other ways, for he can by means of a few strokes of his pencil make some point clear to his client or express his ideas satisfactorily to his draftsmen, or help his contractor to visualize some matter not readily understood from working drawings. Then there are others connected with the architectural profession besides the architect and his draftsmen and engineers who find a knowledge of free-hand sketching of value, for engineers and construction superintendents can often explain to others or make clear in their own minds certain hazy points in construction by means of quick sketches. There are problems which come up in the daily life of anyone which are difficult to express or explain by oral or written word, but which can be easily made clear by even the simplest sketch.

These are only a few of the uses of perspective sketches, but enough to show that they are of immense value to the architect, and this being true it is only natural that there is a demand for draftsmen who are able, in addition to doing the usual work on plans and details, to make such renderings. Men with ability to sketch and render well are almost certain to advance rapidly in the profession, because they are able to serve their employers in many ways. First of all, when a new project is conceived, many little sketches are needed as a means of study; secondly, there is no surer way of creating a favorable impression than by submitting a few attractively rendered sketches to the employer.

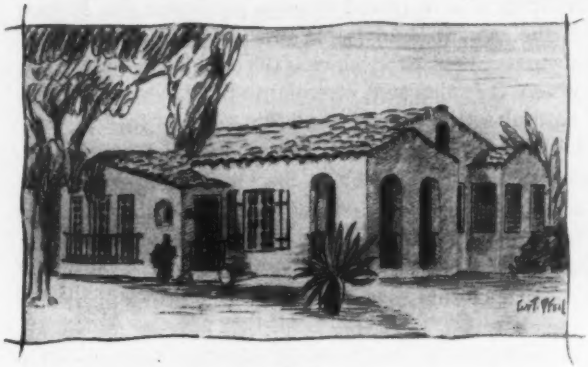
The average client who comes to the architect's office is entirely unfamiliar with architectural drawings. Such drawings mean little to him, even though he may be able to read the blue prints as far as the general layout of the rooms are concerned, and can understand the elevation drawings if they are simple in form, but let them be complicated with numerous projections and varying roof pitches and he finds it impossible to visualize them. Doubtless one of the chief causes for disappointment in the finished house is that the house proves to be entirely different from what it was expected to be.

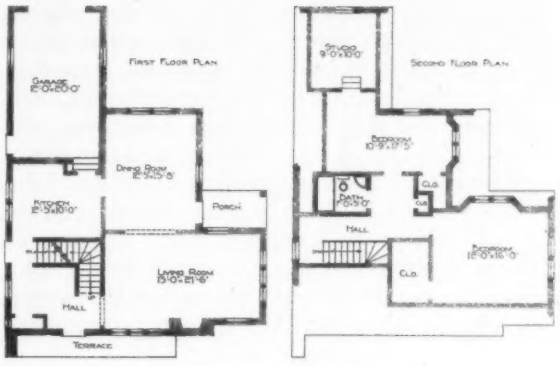
The practice of preparing rendered perspective drawings which clearly show the appearance of the structure complete is growing. Such perspective sketches are of value, for they serve as a means of expression, and as a means of studying the design and arrangement.

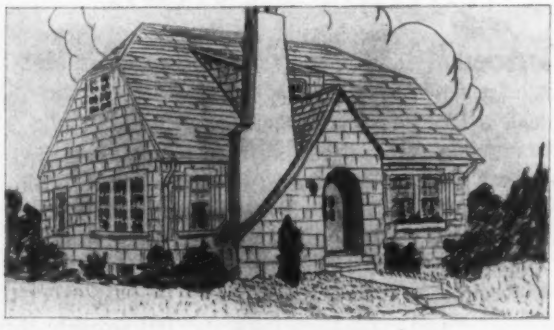
*Instructor of Drawing, High School, Waukesha, Wisconsin.

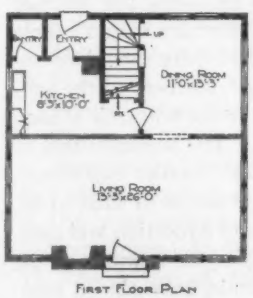
Rendering of Small Houses

The best examples of pencil technique for the usual architectural subjects is the conventional type, such as is employed from time to time in architectural magazines. The student should collect such reproductions as seem excellent and study them in detail. Notice the way in which the various details, such as doors and windows, are indicated. Study the methods of suggesting the different materials — stucco, shingles, clapboard, brickwork, stone, etc. Look at the methods of representing foliage. Copy either the whole or portions of these representations, trying to learn the several

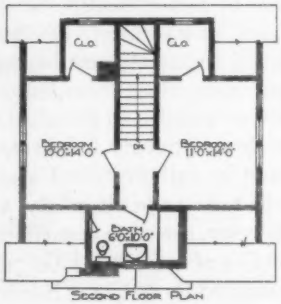




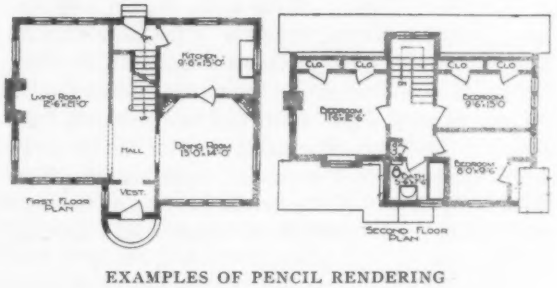




First Floor Plan



Second Floor Plan



EXAMPLES OF PENCIL RENDERING

methods of expression. It is valuable to compare the drawings with photographs and even with the buildings themselves. Sketch directly from the building, trying small drawings of doors and windows and other small portions first.

After considerable practice has been given to the rendering of small details, a rendering of a small house may be attempted. First of all, when starting a perspective sketch, it must be decided in which position to place the house in the sketch. Though this position varies with different houses it is usually well to show much of the main entrance and front of the house. After the position of the house has been decided upon, the station point at which the spectator is to stand is determined, the various vanishing points assumed. Carefully consider the direction of the light, casting shadows with care. If a preliminary sketch is made the final sketch may be rendered from the top down, but usually it is advisable to work from the center of interest out toward the edges, or put in the darkest tones first, later adding the half tones.

It should be remembered that a pleasing relation should exist between the house and its surroundings. In an informal house the landscape should not be too stiff. Curved walks, irregular hedges, shrubbery, etc., will improve a house of the cottage type. A dignified Colonial house demands symmetrical treatment throughout the scheme. Some line or group of lines should lead the eye to the picture. This can be accomplished by means of a path, drive, or shadows on the lawn. A glimpse of a lake or a driveway to the garage or of a distant building seen through the trees will add value to the picture. Care must be taken that these minor representations are not overemphasized or they will take the interest from the house itself. Trees can be shown of any kind and age, and with or without leaves. Bushes and shrubs can be drawn in almost any place and of any desirable proportion desired by the student. Effect may be varied by using either light or dark tones. The setting of the house is entirely within the artist's province unless the building is to be placed on some particular site. If that is the case, it is advisable to show with considerable accuracy that part which falls within the range of vision. It is almost as essential to be able to sketch the natural setting for the building as it is to draw the building itself, and when sketching foliage, the student is acquiring in addition to the knowledge of drawing, certain principles of design directly applicable to architectural work, for there is a very definite analogy in several ways between trees and buildings.

In conclusion may I say that this course in pencil sketching and rendering is not too difficult for an advanced class in architectural drawing. Students who have artistic talent or ability naturally choose architectural drawing in preference to the more stiff and standard type of machine drawing. One cannot expect to be able to develop a class of artists, for but few of the students will be able to develop the technique of pencil rendering in a semester course. The study of rendering demonstrates to the student the type of work expected of an architect. This helps the boy to decide whether or not he should choose architectural drafting as a vocation. Pencil rendering also serves as an excellent means of securing student participation in the study of styles and floor plans of houses.

English in the Vocational School

*M. C. Richmond**

PRACTICALLY all schools that offer instruction which enables the individual to perform some particular function in the commercial or industrial world may call themselves vocational schools, and many of them make use of this name. In a consideration of what to teach in English in a vocational school, I have not in mind vocational schools in general, but those schools in which the mechanical trades are taught, and which operate under the Smith-Hughes Law. In this type of school, English, of the many related and nonrelated subjects offered, has come in for more than its share of controversy. In mathematics, science, drawing, etc., analyses worked out by committees under the supervision of state departments of education and of the various departments of organized labor have proved most helpful. In most instances, these analyses have indicated what should be taught in each of the subjects offered in the vocational school. But English, which is of such great significance in the purely academic school, while it has not been entirely neglected, has been more or less allowed to shift for itself. Probably this has been done with the hope that through its own efforts it would some day make a name for itself.

State departments of education have not definitely decided what to include in a course in English in a vocational school; organized labor has felt strongly the need of better English for its members, but has not stated for a certainty just how extensive such a course should be, merely mentioning that there should be improvement along these lines; and teachers of the subject, practically all recruited from the academic school, no doubt strongly influenced by the indefiniteness of those in authority, and also their earlier experience, have been, to put it mildly, all at sea as to what to do. However, the state departments of education and committees of organized labor, despite the newness of the thing and its resultant inexactitude, have offered valu-

*Red Bank, New Jersey.

able suggestions and given helpful assistance wherever possible, and these suggestions together with ideas worked out at conferences of teachers of English in a vocational school, have at least given an individuality to this subject. This is a big step in the right direction, since English in the vocational school has for its purpose something entirely different than the teaching of English in a school preparing for college.

The vocational student is to be educated as a tradesman. With that idea in mind, the following objectives in the teaching of English suggest themselves.

1. He should speak and write English that is not objectionable.
2. He should enjoy the reading of trade and non-trade literature in his leisure.
3. He should be able to spell and pronounce the words most commonly used both in his social life and in his profession.

Perhaps you will agree with me that these are sufficient accomplishments for the future tradesman and that the instructor who attains these ends has done what he is expected to do. Ours is not the task of educating for the many things that may happen, but for that which we know will happen; and we know that the student is to be a tradesman when he leaves school.

Now to accomplish the first objective; namely, the speaking and writing of English that is not objectionable. For the future tradesman, this work should be reduced to its simplest form. This means that the English must be workable and understandable, and that it will give the student just the information he needs, and no more. It must not be forgotten that the student before entering the vocational school has been taught English each year while he attended the elementary school. If he has not made a success of what was taught there, nothing will be gained by a mere repetition of the same type of material. What he needs now, is English minus the former stumblingblocks.

That means that the teaching of technical English as a formal subject must be eliminated. In its place must be substituted corrective exercises either in the form of lesson sheets or whatever other device or devices may prove effective. It is to be eye and ear training instead of giving a reason for everything that is done. Of course, if a technical reason is asked for, it will be given, but the making of a sustained effort along these lines is altogether out of harmony with the simplicity of the objectives that are to be striven for. The following order in corrective lessons is suggested:

1. Difference between sentence and phrase.
2. Agreement of subject with predicate.
3. Plurals of nouns.
4. Possessives of nouns.
5. Gender of nouns.
6. Agreement of pronoun with antecedent.
7. Case of pronouns.
8. Use of adjective and adverb.
9. Comparison of adjectives and adverbs.
10. Proper use of difficult verbs most commonly used.

In presenting these exercises to the students these terms are not to be used; they are to be offered merely in the guise of corrective exercises.

After these exercises are completed, and they may be worked upon individually to satisfy the various learning speeds of different students, there should come a brief study of the ordinary marks of punctuation. Here again the corrective method should be applied, but not every conceivable use of every mark should be the aim. Following that, class instruction should be offered in the matter of correct composition. It is quite enough that the student should know he is to adhere to his topic; that one sentence, so far as possible, should lead to the next; and that paragraphs should have the same relation to each other. Whether the student knows exactly how to write, narration, description, exposition, is absolutely beside the point. That he write intelligible what he is writing is the material thing. When he gets out of school, the apprentice will have very little writing to do. In the majority of cases he will call instead of write for a position. If there is any writing to be done, it will be the filling out of a form. The filling out of such forms may therefore be profitably included as a part of his English work. He also may be called upon to make a written report. This, too, will, no doubt, be on a printed form. He will want to write a social letter, and he may be called upon to write an order. The latter even is doubtful. If any regular composition is to be taught, it may follow the general lines of the following material which is part of the work of the Navy Yard Apprentice School, Philadelphia, Pa.

The Chinese Junk Ning-Po

Shipbuilding in the last 25 years has made long strides. In luxury, comfort, in stability and speed it is hard to beat the modern steamship, but when it comes to durability, the Chinese of the early nineteenth century could teach the modern shipbuilder a trick or two. How many modern ships would be capable of a 7,000-mile trip across the Pacific after seeing 106 years of active service? This is the remarkable record set by the Chinese junk Ning-Po, built at Foo-Chow in 1806, supposedly for the regular Formosan trade, although her intricate interior indicates that she was actually built for that trade popular in her time — smuggling opium and slave girls.

The ship is 150 ft. long, 35 ft. beam, with a depth of but 15 ft. She has 3 decks, 9 watertight bulkheads and a maze of secret compartments that only a Chinese mind could conceive. In dark corners of the hold many of the timbers are hollowed to make hiding places for opium.

W. E. Dodd.

Spelling should not be presented as a separate entity in the English course. Instead, it should be limited to the giving of the various recognized tests at the beginning of the course, and as soon as a student has attained a 100-per-cent knowledge, spelling, as a separate subject, should stop for him. The teaching of the trade technical terms may be delegated to the teacher in the shop. No one knows better than he what words should be taught and he has the best opportunity to

motivate his teaching. If expediency dictates otherwise, this work can be offered by the instructor of English and should be continued until practically all of the terms of a trade are exhausted. The idea of deferred education should be kept in mind here to the extent that terms which the shop instructor does not deem of immediate necessity should not be taught.

Finally, the tradesman of tomorrow will work fewer days than he does today. What to do with his leisure becomes a problem. The English instructor can be of great assistance here. His job is to make the student feel the romance of the printed page, and to implant in the student a desire to read either trade or nontrade literature during his free moments. There is such a wealth of biographical material of an interesting nature on the market today, there is so much good fiction, and there are so many technical magazines interestingly written that it should not require any very great effort on the part of the instructor to secure the proper material.

It must not be forgotten that the teaching of English in the field of vocational education is practically a new one, and that the work is largely experimental. The suggestions contained in the foregoing do not therefore represent the last word on this subject, but they merely represent the writer's own experiment in deciding what to include in his own course of English for his students in a vocational school.

Care of Tools in the Machine Shop

George C. Donson, Washington High School, Washington, Pennsylvania

DURING the school year the care of the tools in the machine shop should receive particular attention. At the beginning of the machine-shop course the student should get an idea of the investment which the school has made to afford this instruction. If it is known that an engine lathe costs from $600 to $1,000, or a milling machine from $1,200 to $2,000, the student may exercise a little more care in their use. Proper care helps to keep the machinery in condition for use. In a well-kept shop every day is a cleaning-up day, and the instructor does not wait for vacation time, a holiday, or the close of the term for a general clean-up. The method, described herewith, for the care of tools may not be the best one, but it is passed along for what it is worth.

Care of the Engine Lathe

The engine lathe is the most important machine tool in the shop, and frequently it is the most abused. Oil is cheaper than machinery and, in every well-organized shop, there should be a definite time for oiling all machines. The oiling in our shop takes place every Monday morning. This work is done by two students, one does the work while the other watches. The following week the watcher is the oiler, and another student from the class becomes the watcher, while those who have had experience in oiling become inspectors who look over the machines to see that the oilers have done a good job.

There is a tendency on the part of students to strike the shears of the lathe with the file when filing revolving work. This pernicious habit may be overcome by permitting the student to strike the file on the tool post, setscrew, or on a block of wood, which may be provided for this purpose. Each lathe is equipped with a wood tool box which contains a tool holder, an inside boring tool, and a brush for cleaning. While the student is at work, the tools are placed in this box, hence there is no occasion for him to place anything on the shears of the lathe. The files are kept in the stand (see Fig. 1) which is located on a bench near the lathe operators.

A compound made of oxide of red lead, mineral oil, and graphite, for lubricating the dead center, tends to reduce friction and prevent wear. This compound is better than white lead alone. Live centers made from machine steel, parts of automobile drive shafts, or axles, wear well and may be dressed with a file. The dead centers are hardened and ground. The ball-bearing dead center is now used in some shops, and this relieves the instructor of much worry.

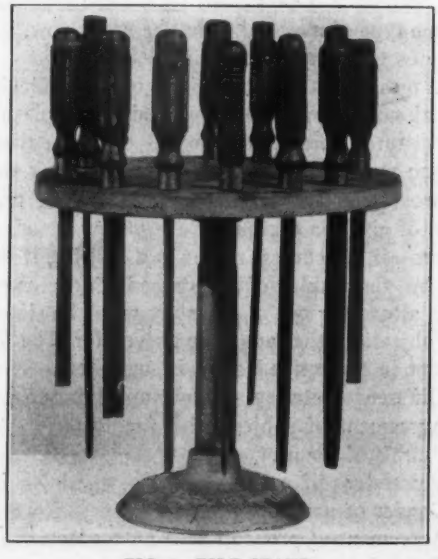


FIG. 1. FILE STAND

In industry the tool-post wrench is always kept on the tool post, hence the writer follows the same method in his shop, although some argue that for safety reasons, it should be kept elsewhere.

During the summer vacation machinery has a tendency to rust, especially if the shop is below ground level. A coat of heavy automobile oil, cup grease, gun grease, or tallow, applied to the finished parts, will prevent this. These coatings may be easily cleaned off with kerosene when the lathe is needed for work.

Keeping the Tools Sharp

In most shops where the classes are large, there will be students available for tool grinding. A box may be kept for the dull tool bits, also one for the sharpened tool bits, and one of the students may be selected as a foreman whose duty it is to see that these boxes receive attention. It is a debatable question just at what stage in the progress of machine-shop instruction a student should be taught to grind a tool. The plan used by the writer is to give the student a piece of pine wood, the size of the tool bit, and, after a demonstration, let him shape a cutting tool in wood. When he is familiar with the trade terms, rake, clearance, etc., he is ready to begin actual tool grinding. Some students may, however, be obliged to shape three or four of the tools in wood, before they are ready to attempt tool grinding. In some shops a large wood tool is shaped and is suspended in the shop so that the students may gaze upon this as a pattern for doing their best work. A student should know what the tool is expected to do before he is taught to grind.

Excellent instruction sheets on the use and care of files, saws, and other tools are available from several manufacturers. All of these will be found very helpful in the classroom.

FIG. 2. TOOL CABINET

FIG. 3. STOCK RACK

The Small Hand Tools

The small hand tools, such as hook rule, combination square, dividers, plug gauges, inside and outside calipers, thread calipers, scribers, center punches, etc., are kept in a silhouetted cabinet on the shop wall. This cabinet, Figure 2, is situated near the machines and the student may take the tools as he needs them. Two tool checkers are selected from each class whose duty it is to see that all the tools are in place before the class is dismissed. The micrometers, indicator, and thickness and thread gauges are kept in the instructor's desk. The instructor has opportunity to give additional instruction on the use of these tools before they are given out.

The straight wrenches are also silhouetted on the back of the door of the special tool, jig, and fixture cabinet. It is an easy matter for the tool checkers to see that all tools are returned if there is a special place for each one. White enamel may be used for the inside of the tool cabinets, and black shellac or lacquer for the silhouettes. The supply cabinet, which contains emery cloth, machine bolts, hack-saw blades, countersinks, drills, reamers, files, belt fastenings, etc., is kept locked, and these articles are issued only as needed.

About two weeks before the close of the term, an inventory is made of all the tools and supplies in stock. A *want book*, kept by the instructor during the term, helps to make up the requisition of supplies for the year. It is difficult for one to secure all of the supplies that he will need unless he has some system of making up requisitions and ordering supplies, especially if he must buy for the year.

The rack for holding steel rods (Fig. 3) was made in the shop by the students. Short pieces of 1½-in. pipe are used for spacers between the arms and may be cut to any desired length. Furthermore, the stands may be set any distance apart to accommodate the lengths of steel in stock. It occupies little space and may easily be moved. The small castings for projects about the shop are safer when kept in a cabinet under lock and key. If the supplies of material are open to students, the tendency is to use up too much material.

Color Harmony in Finishing Woodwork

*Lloyd Benson**

NO interior decorative scheme need be outraged today because of improper color effects on shop projects. Finishes in countless shades are available so that it is easy to choose one that will harmonize with the furnishings in almost any type of house.

Few people, however, can devote much time to an extensive study of the principles of decorating and color harmony, and only those financially able can employ the service of a professional decorator.

Color is such a factor in our daily lives that we even speak of it unconsciously. We say that the future looks black or that a gray day makes one feel blue. At other times, when the green fields are flooded with the golden-yellow sunlight, we may say the future looks rosy. Sunrise, sunset, the sky, with its changing clouds and water scenes, all tend to give a color harmony reaction.

Science has proved that harmony in color makes us react favorably and pleasantly, while dullness and lack of color has exactly the opposite effect. Pretty shades make us want to draw near them, while we instinctively shrink from inharmonious hues. This shows how colors affect the human emotions and how they produce fear, enthusiasm, cheerfulness, doubtfulness, or uncertainty.

A good piece of work can be ruined by a poor finish, while on the other hand, an inferior article may be considerably improved if the proper finish is applied correctly. It is not the purpose of this article to make the novice a skilled decorator, but rather to present a general idea of the harmonization of colors; that is, to tell how to mix the materials for obtaining certain colors and to discuss different methods and processes of finishing that can be obtained through various combinations.

By reason of popular demand, current tendencies in modern furniture decoration seem to reflect a very decided approval of extreme gaudy contrasts or the blending of soft, restful color schemes. Perhaps the only apparent reason for this is the weariness produced by the everlasting sameness obtained with the different kinds of stain on wood. The atmospheric setting, tastefulness or desirability all tend to govern the shades desired.

There is no reason why furniture in a room should not or cannot be made to give a harmonizing blend of colors or a harmonizing contrast of colors. The introduction of spray guns has done much to further the two- or three-tone idea, to say nothing about the use of the sponge finish, crumpled-newspaper finish, stipple-wood-block finish, door-knob, and broad-side-of-a-brush finish.

In finishing a project many things have to be taken into consideration. The first to be considered is the surroundings in which the finished project is to fit. Then, too, the purpose of the project and its design weigh heavily in deciding on its finish. Thus one is confronted with the harmonious blending and contrasting of colors. This is a subject that one may study for many hours, only to find that but a mere beginning has been made on that big subject — color harmony.

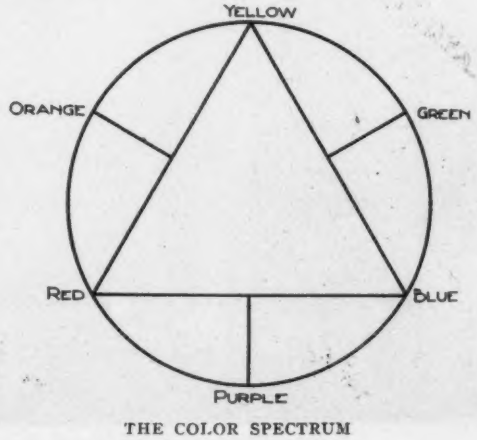
Of the several kinds of beauty, it is said that the eye takes the most delight in color and nothing reveals the expression of an individual taste more than color.

Warm and Cool Colors

Colors may be divided into two classes; namely, warm and cool colors. Warm colors are those which contain certain elements of red and yellow, or those which produce the effect of light and heat. The cool colors are green, blue, and gray, which are in contrast to warm colors. Nature is a good guide in the use of these colors, and her example is a reliable one to follow. It is known that the sky and grass are pleasant to gaze upon indefinitely, while the sun and fire, though attractive, soon become offensive to the eyes. Thus we can say that cool colors, such as grass and sky, may be used in large quantities; they never become so tiresome to the eyes. The warm colors, as those of the sun and fire, should be used in small quantities to lend brightness and warmth to the background. When it is desired to combine various colors, certain considerations are of primary importance in another vast and important field of study related to color harmony.

Color Harmony

There are two kinds of color harmony; namely, contrasting color harmony, and blending color harmony. Bright, flashy colors may be acceptable in certain settings, while soft, blending, restful colors may be more satisfactory in other instances. No hard-and-fast rule can be laid down for using one or the other of these



THE COLOR SPECTRUM

*Longfellow Junior High School, Madison, Wisconsin.

harmonies since surroundings, settings, and purpose, must govern the color harmony that is to be used.

Rays of light, such as the sun's rays, are conceded to be white, but if broken up by a prism, they will produce what is known as a spectrum of colors. All colors of the rainbow in their consecutive order will be seen. The three predominating colors, from which all the rest are formed, are red, blue, and yellow, and these are known as primary colors. Equal amounts of any two of these colors produce what is known as a secondary color. Thus orange may be produced by a combination of red and yellow, green from yellow and blue, and purple from blue and red.

Complementary Colors

When two colors mixed together produce a white, or rather a light gray, these colors are said to be complementary colors. For instance, we know that the three primary colors when used in proper proportions produce such a light gray, and if we wish to find the complement of any separate color we must choose the one which is made up of the other two. Thus, orange, which is made up of red and yellow, will be the complement of blue, and so on. By referring to the color spectrum the opposite colors will always be complementary to each other.

Complementary colors when used together enhance each other and make pleasant combinations to use in finishing. Unless one is confident that the colors are harmonious, a safe rule is to use complementary colors, because they are almost sure of resulting in a pleasing effect.

The following combinations will be found to blend well together:

Brown blends well with light green, yellow, orange, red, purple, cream, and tan.

Blue blends well with light green, purple, lavender, and gray.

Cream blends well with yellow, orange, pink, gray, tan, and brown.

Gray blends well with all blues, with all greens, purple, lavender, and cream.

Green blends well with dark blue, yellow, lavender, and gray.

Lavender blends well with all blues, light green, purple, gray, pink, and brown.

Maroon blends well with pink, brown, and purple.

Orange blends will with yellow, red, cream, tan, and brown.

Pink blends well with red, purple, lavender, and cream.

Purple blends well with blue, green, pink, maroon, lavender, gray, and brown.

Red blends well with orange, pink, and brown.

Tan blends well with yellow, orange, cream, and brown.

Yellow blends well with green, orange, cream, tan, and brown.

When blended colors are not desired, or at hand, it is possible to use contrasting colors that harmonize well together.

Brown contrasts well with all blues and with green.

Blue contrasts well with yellow, orange, cream, tan, and brown.

Cream contrasts well with all blues, all greens, red, purple, and lavender.

Gray contrasts well with yellow, orange, pink, and lavender.

Green contrasts well with orange, pink, red, cream, tan, and brown.

Lavender contrasts well with yellow, cream, and tan.

Maroon contrasts well with green, yellow, gray, cream, and tan.

Orange contrasts well with blue, green, purple, and gray.

Pink contrasts well with green and gray.

Purple contrasts well with yellow, orange, cream, and tan.

Red contrasts well with green, yellow, gray, and cream.

Tan contrasts well with all blues, all greens, and lavender.

Yellow contrasts well with red, maroon, lavender, and gray.

Using More Than Two Colors

Quite often it is desired to obtain or employ two soft, blending colors over a contrasting color or a harmonical contrast over a soft blend of the two.

When more than two colors are used in contrasting, a more pleasing effect will be obtained provided two of the colors used are blends and the third a contrast instead of using three contrasting colors. It also is possible to obtain a pleasing and delightful effect by combining any of the three blends.

When three colors are used in harmonizing, it is best to have one color predominate and the other two colors less prominent, the second and third colors can be used in equal portions or one can predominate over the other two.

Black can always be used with any color, preferably in modifying amounts. However, when it is used with a large amount of a cool color, it should have an added touch of some warm color to give it life and attractiveness.

Hand in hand with color harmony goes the problem of paint mixing and tinting. Considerable difficulty is ordinarily encountered and experienced in the process of matching and duplicating colors. The problem becomes complex, because the colors produced by different paint manufacturers vary greatly. For example, the red of one company may be lighter than the red of another, or the blue of one company may be darker than that of another, and so on, down through the color chart. The standardizing of these coloring materials would contribute enormously to the efficiency of commercial practice, and thus simplify the procedure of color mixing.

However, to the individual there is a sort of satisfaction and glorified sensation in creating a color scheme, and knowing that no one else has that exact shade or combination.

Obtaining the Desired Color

There are two ways of obtaining a desired color. Two or more different colors may be mixed to obtain a desired color, or one may begin with white and tint with color pigments and thus obtain the desired color. Either can be used to advantage provided one knows what and how to mix, otherwise there may be quite a waste of paints. The latter method will be described more in detail later, as it is easier for a beginner to obtain good results by using it in preference to the other.

In mixing paints to obtain different colors there are a few precautions that one has to take. Always be sure to mix plenty of paint for the entire job before starting

to paint. It is better to have some left than to run short, especially if tinted paints are used. Also it is an excellent idea to strain paint through a wire strainer or several thicknesses of cheesecloth before using, as this will be a further safeguard against lumpy colors and streakiness.

There is no limit to the number of shades and tints obtainable by coloring white paint. A desired tint may be obtained by adding soluble coloring matter according to the shade or tint desired. These tinting colors are known as *colors-in-oil* and can be obtained at any dealer who handles paint materials. A good reliable brand of these colors-in-oil should be used, as cheap ones lack tinting strength, fade out, and never give complete satisfaction. The power of the color's resistance to light and air as well as to oxidation must, of course, be considered.

In tinting, it is never wise to put in all the color called for in the formula. Weigh or measure out the color and put in a little at a time taking care to stir and mix well between each addition. *Stop* when the exact shade desired is obtained.

A few suggested formulas that can be used for mixing purposes, follow. It must be remembered, however, that formulas for mixing paints are at best only approximate, hence some allowance must always be made for variations in the strength and tone of colors of different manufacturers.

BROWN — Two parts venetian red with one part lampblack to one hundred parts of white lead.

BLUE — Basic color mixed with white lead. Add the blue to the white lead until the desired shade is obtained.

CREAM — Four parts of french ocher with one part medium-chrome yellow to three hundred parts of white lead.

GRAY — Lampblack is added to white lead. Sometimes a touch of blue is added to give the color life.

MAROON — Ten parts of venetian red with one part of lampblack.

ORANGE — Mix yellow and red. The more red that is added the darker the orange tint becomes.

PINK — Venetian red is added to white until the desired shade is obtained.

PURPLE — Equal parts of red and blue. The addition of an extra amount of one color or the other will give a variation in the resulting color.

TAN — Seven parts of french ocher to twenty parts of white lead.

IVORY — One part chrome yellow to two hundred parts of white lead. French ocher can be used in place of chrome yellow.

BUFF — One part of french ocher to twenty parts of white lead.

LIGHT BLUE — White lead tinted with blue.

DARK BROWN — Four parts of french ocher with one part of venetian red with a little lampblack.

THE COMPOSITE SHOP

There are many advantages in the composite shop. It is an economy to have one man teach all lines of work. It helps the boy to become acquainted with various devices and equipment. The teacher in such a shop should be an understanding man, who is able to do a little of everything. He must be a higher-grade man than the one who teaches plain shopwork. —*C. A. Prosser.*

THE NEW TEXTILE HIGH SCHOOL, MANHATTAN, NEW YORK CITY, WHICH WILL BE READY SOME TIME DURING THE PRESENT SEMESTER. WILLIAM H. DOOLEY IS PRINCIPAL OF THE SCHOOL.

Shall High Schools Teach Aviation?

*Charles Fleischman**

THE intense interest in commercial aviation during the past two years, and the fact that more than a score of American high schools have scheduled courses of instruction in some line of the work, is causing many people to ask the foregoing question.

The large increase in the number and in the enrollments of private flying schools indicates that the high cost of flying training is proving no barrier to ambitious young men. Are these schools really giving the training that will fit their graduates for remunerative positions in commercial aviation? This is the question that is interesting the public, for the public is sold on commercial aviation and is interested in having an adequately trained personnel that will provide for an expansion program to use all the facilities of all our aircraft factories.

The Department of Commerce has been given the responsibility of approving the equipment and licensing the men engaged in interstate activities. It has issued a bulletin on "Aviation Training," (*Aeronautics Bulletin No. 19*, Department of Commerce, Aeronautics Branch, Washington, D. C.). In this bulletin, ten of the positions in aeronautics which may be obtained after proper training and experience are discussed. The positions are as follows: pilot, mechanic, aeronautical engineer, factory man, airport designer and constructor, airport ground man (helper), radio operator, traffic agent, advertising and publicity man, salesman.

A few of these positions are of such a technical nature that a college training is demanded, others are open only to men who have made good in some other line of the work; so the field left for our high schools is just about limited to the groundwork required of pilots, some elementary work in design, and the mechanical field. The opportunities for high-school graduates in these three fields should be the determining element in their selection as high-school subjects.

Eight air transport companies reported to the Department of Commerce that the average time in the air of their pilots at the time of employment was over 1,000 hours. The average number of pilots employed by these companies was 3, while the average number of ground engineers and mechanics employed was 26. Most of the companies reported that their pilots were high-school and college graduates with additional aeronautical training, while a high-school education seemed to be the minimum for the mechanics. At present, the Army and Navy seem to be able to fill all needs as to pilots, but there is already a shortage of trained men for positions as ground engineers and mechanics.

On the basis of this report, it is evident that the public schools will find their field of greatest usefulness in courses for mechanics and ground engineers, although the groundwork for pilots will have its place. The mechanical field is almost untouched by other agencies, aside from our Army and Navy air services, and in this field lies the challenge to our high schools to meet the needs of national progress.

Not all our high schools will be in a position to meet the challenge, for a great deal of space and a large quantity of equipment in the hands of specially qualified teachers must be provided. The teachers must be licensed by the Department of Commerce as airplane and engine mechanics, and, in addition, should be trained as teachers. The demand for the training may tempt boards of education to inaugurate such courses, without adequate space and equipment, or properly trained teachers for the work.

Some of the equipment may be obtained on a loan basis from the Army and Navy air corps. Packing and transportation will have to be paid, but thousands of dollars worth of equipment have been loaned to schools which show that they are ready to use it to advantage. Other equipment is often available from local aviators who find obsolete equipment a white elephant on their hands. Modern equipment must be purchased to supplement that loaned and donated.

A steel hangar with a concrete floor will be suitable in many climates, but brick walls are a necessity in colder communities.

A careful selection of students for this work will have to be made in order to train those who will actually enter and make good in the aviation field. Some means of eliminating those who fail to grasp the work in order to replace them with those who will succeed, must be adopted. The additional expense of the work requires that only the successful ones be retained in the course. The needs of the public also demand that all the available resources be used for those who will take their place in the industry.

If the shortage of mechanics were a temporary matter, the public schools would not be justified in providing highly specialized training requiring expensive space, equipment, and instructors, but the very requirements of the industry indicate that the shortage is bound to continue. The Department of Commerce demands one year of experience as a helper in the trade before the airplane mechanic's license will be granted and two years of practical experience, one of which must be on aircraft engines, for the engine mechanic's license. These requirements make it necessary for the schools to look forward three or more years in their training program.

The National Government is providing beacon service and emergency landing fields, several states are maintaining National Guard aviation units, and many municipalities are providing airports. A shortage of trained mechanics threatens to delay progress. Shall not the public schools provide the necessary training?

*Central High School, Tulsa, Oklahoma.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. METZ, Editor

THE TEACHER'S OPPORTUNITY

What the final results of a teacher's efforts are, will ever be problematic. The group of youngsters that enters the classroom on the opening day of a school year may harbor enough future greatness to astound the world.

No one can point out the boy in each group who will thus distinguish himself. Edison, Westinghouse, Ford, and Lindbergh, no doubt, were at times as vexing and as inscrutable to their teachers as the average boy in the school shop throughout the land is apt to be to his instructor.

Yet the great men of all nations have grown up under the tutelage of their elders, and these geniuses have frequently developed their greatness by making efficient use of the knowledge gained from an inspiring teacher.

Of course, not every teacher is credited with the results of his efforts. Frequently his part in the making of a genius is entirely overlooked. But, be that as it may, the teacher's influence is so far-reaching that every member of the teaching profession can well be proud of his exalted duties and responsibilities; yet he also must humbly consider the far-reaching effects of any action of his which may not be exactly as it should.

That even a mere statement, casually uttered by the teacher in the classroom, may result in discoveries affecting the entire world, is evidenced by the story of aluminum. Professor Jewett's statement that the inventor of a method of producing aluminum on a commercial scale would be a benefactor of mankind fired the imagination of Charles Martin Hall. With energy and perseverance this young student of chemistry went to work. In the school laboratory and at home he labored ceaselessly; hands and mind at the task. Where slender means could not be stretched to cover the cost of needed apparatus, crude makeshifts were devised to take its place.

The earlier experiments of men who had grappled with the problem were carefully scrutinized, an entirely different idea was outlined, and, after anxious time-consuming efforts, a few little buttons of aluminum were finally produced.

Contrary to expectations, Hall did not forget the part that Professor Jewett had played in this discovery. He felt that Jewett ought to be the first one notified of the discovery, and with the words "Professor—I've got it," Hall ushered in the *Age of Aluminum* on February 23, 1886.

There may not be many Hall's but there ought to be more Jewetts, more teachers who can arouse in their students the spark of ambition to be and to do. This is the duty and the privilege of every teacher, and it lies within the power of the incumbent of every teaching position, no matter how humble, to do his share in bettering the world if he but wills.

—⟡—

OUTLINE OF THE SHOP COURSE

Mr. John Doe is teacher of industrial arts at a certain high school. He is an excellent mechanic himself, and his students like him as a teacher. He has made a careful selection of projects for his shop course, and his lesson outline, properly framed, is hung in the shop where every student may see it.

Mr. Doe is quite proud of this neatly lettered outline, and he tells with pride that it has stood the test of time. He has used it for eight years and, according to his statement, it still answers very well.

At first sight, one sees little to criticize in Mr. Doe's outline. A reaction coming from a man whose sons attended Mr. Doe's classes, however, gives one an inkling of what is wrong with the outline. This man says: "I have had three sons attend Mr. Doe's classes during the past five years, and, as a result, we have three tabourets and three neck-tie holders in the attic. Mother does not care for flowers, hence we do not need the tabourets, and as for neck ties—my sons wear the few extra ones that I possess so I have no need for a neck-tie holder." Then he continues, "The work which the boys did on the projects they brought home is quite commendable. Mr. Doe surely makes them hold to a standard, but the three tabourets are so nearly alike that the boys can't pick the one which they individually made. The same is true of the neck-tie holders."

The trouble with Mr. Doe's outline is its inflexibility. The individual projects are good, but they do not provide for varying needs of a large class. Instead of one project which embodies certain processes, Mr. Doe's outline ought to offer a group of projects covering the same spread of tool processes, so that this father could not utter his half cynical, half good-natured criticism of the work done in the school shop of the high school attended by his sons.

Then, too, the outline of instruction should be brought to date. If this is not done, the danger of making use of antiquated models is imminent. As styles change continually in the industrial world, the school product also will have to undergo continual change. Unless an outline of instruction is flexible, as well as up-to-date, it will not adequately serve the purpose for which it is intended.

—⟡—

THE VALUE OF GROUP PROJECTS

One of the objectives of education is to prepare the student to take his position as an integral part of society. To accomplish this objective then, school training on group projects will assist the student to

acquire correct attitudes for his future life. This does not mean at all that the individual instruction method should not be used in the school shop, but it does mean that the community spirit should be fostered as much as possible by consciously planning on ways and means to give the students the responsibility of achieving worth-while objectives with the class working as a whole.

Of course, it is not a new idea to have student foremen, or student supervisors assume responsibility for some of the routine work done in the school shop, as, for instance, during the cleaning-up period.

The introduction of this type of procedure has usually been done, however, because it was helpful in reducing the teacher's load, although the value of the foremanship training for the boy was recognized as a by-product of this method. The social aspect, however, has been overlooked in most instances and the value of the work has been lessened by this fact.

Emphasizing any objective or group of objectives is valuable because it gives more direction to the work. The social value of having individuals working for a common goal should therefore be recognized by the shop teacher.

In this connection also, the judicious use of group work as represented by the production method in the preparation of objects for use in the school shop or school system may be made use of in emphasizing social and civic training. In this way, the work cannot only be made more palatable to the student who feels that he ought only to work on projects that are his own, but the value of coöperative endeavor may be objectively placed before the student.

—⋄—

WHAT MUST BE AVOIDED

With the industrial use of motion-study job sheets in mind, the shop instructor may easily fall into the error of overmechanizing his instruction sheets, operation sheets, job sheets, or whatever other name may be given to the many varieties of instructional material now found in the school shop.

If these instruments of instruction are not properly constructed, there is grave danger that they will rob the student of an opportunity to do his own thinking and planning. If every action which the pupil is to make while reaching the objective of a given lesson is prescribed and circumscribed, where will his own planning function? If every tool that he must use is carefully named in the lesson, how will he know what tools to choose for a job that may arise at home? Of course, this is an extreme view to take, yet it must be remembered that these instruction sheets are not merely for the gifted student who will do his own thinking in spite of what the teacher gives him in the way of instructional materials, but they are for all students. This means that they also go into the hands of those who, following the lines of least resistance, will mechanically follow directions, allowing their thought processes as little exercise as possible.

Probably the instructor himself may remember how easy it was for him to follow the directions in his chemistry manual. The experiment could be performed quite successfully with but a minimum expenditure of mental activity.

In every teaching device—and that is what these instruction sheets are — care must be taken to check their ultimate influence on the student. The successful functioning of a plan usually depends upon more than one factor. The mere fact that an instruction sheet seems to solve some of the teaching problems better than some other method, does not preclude the existence of shortcomings that must be circumvented by some means or other.

Making the instruction sheet do the thinking for the pupil is one of the things that must be guarded against. Under no condition should the student be robbed of an opportunity to do individual planning, and the instructional material must be so devised that it merely acts as a guide to him in the performance of a given task.

—⋄—

THE RIGHT KIND OF THINKING

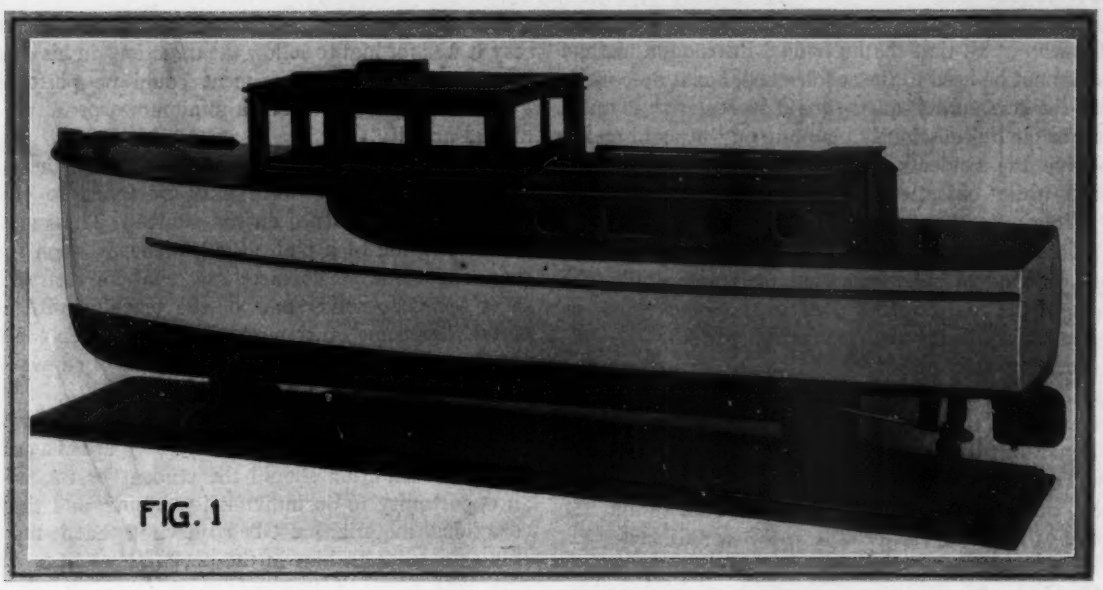
The main duty of the instructor, both in the shop and in the classroom, is not to make the student skillful but to make him think. Instructors who do use thought as a guide, of course, take it for granted that the student is to be taught to think in the right direction.

The problem, however, is exceedingly important. To think the right kind of thoughts is vitally important to everyone. The greatest troublemakers in our social structure are the criminals who can think cleverly for what they conceive to be their own good, although, as a matter of fact, it is for their own destruction and for the disintegration of human society of which they are a part.

The appalling number of young boys and girls still in their teens or early twenties in the penal institutions shows the great necessity of consciously tackling this important problem which confronts the teacher—not only to make his students think but to make them think the right kind of thoughts.

That this is vital becomes apparent when one considers the care with which other objectives are recognized in the work given to the student. No trade teacher, for instance, would think that he was satisfactorily fulfilling his duty toward the students in his class who were following a trade course, if he were using an outline of instruction prepared for industrial-arts students. He knows that the trade preparatory objective must be very apparent in every phase of his work.

In the same way, the general objective of preparing for citizenship must become more and more apparent in schoolwork. Right thinking must not be a side issue that is introduced incidentally, but consciously and purposefully.



THE 30-IN. MODEL CRUISER

A 30-in. Model Cruiser

*Claude William Horst**

(See Supplement 206)

A 30-in. model of a modern 40-ft. pleasure cruiser, when properly equipped with a suitable power plant, is quite ideal for miniature boat racing. The proportional height above the water is sufficient to allow its use in comparatively rough water, especially when the cabins are in place. Then, too, the displacement is enough to permit the use of a power plant weighing from three to four pounds, which allows considerable latitude in the choice of a motor, and makes possible a surprising speed.

White pine is an excellent material for the hull, but any soft, finely grained wood that is easily worked makes a good substitute. The lifts should be cut from slash grained material, that is, the grain of the wood should run as nearly as possible parallel to the top of the lifts, so that the outside surface of the hull may be given a smooth finish.

In the hull layout, Figure 3 (Supplement No. 206), dimensions are given in feet, inches, and eighth inches, in order to make it possible either to enlarge or to reduce the size of the model accurately by merely changing the scale and using the same figures throughout. For the 30-in. model the dimensions given in the hull layout must be laid out at a scale of ¾ in. equals 1 ft.

The pieces from which the two halves of each lift are to be cut should be tacked together, the curves marked, the two pieces sawed out, and the exterior curves finished to the line, before the pieces are separated. It is a good practice to cut the inner side of the lifts at least a quarter of an inch inside of the line given in the drawings and to finish to the line after the lifts have been glued together. Otherwise the pieces are so flexible that it is difficult to get the hull together accurately. A band saw is the first choice for a cutting tool in this case, and a disk sander for finishing the pieces to the line, but if these machines are not available, hand tools do very well.

After the lifts are cut out and the outside of each set finished to the line, it is time to glue together lifts 1 to 6. Lift 7 is left until later. It must be kept in mind that the two halves of the hull are to be glued up and finished separately. Then, with the backbone structure in between, they are glued together later. Figures 4 and 5 show the lifts of each half of the hull arranged for gluing, with the two halves placed so that one set of clamps will take care of the whole job. Great care must be taken to place the lifts properly when gluing. It will help if the position of the lifts is laid out on a piece of paper about 14 by 34 in. Figure 4 shows the arrangement of the paper with the lifts properly placed. The lifts must be tacked at either end to prevent shifting. The paper will also prevent the lifts from sticking to the top of the worktable, as more or less glue is always

*Instructor, Milwaukee Vocational School, Milwaukee, Wisconsin.

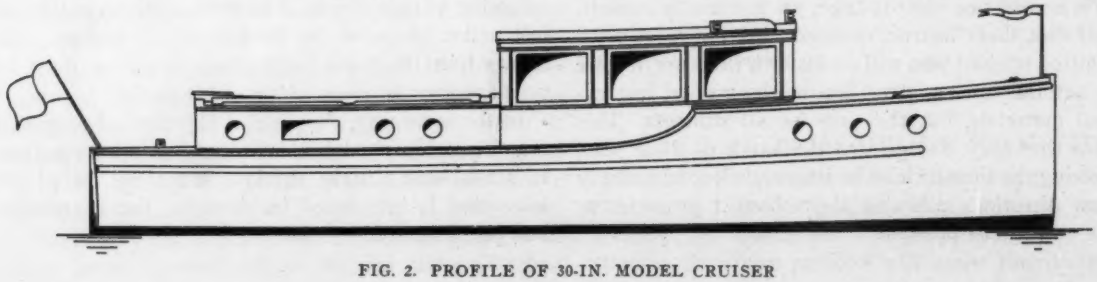
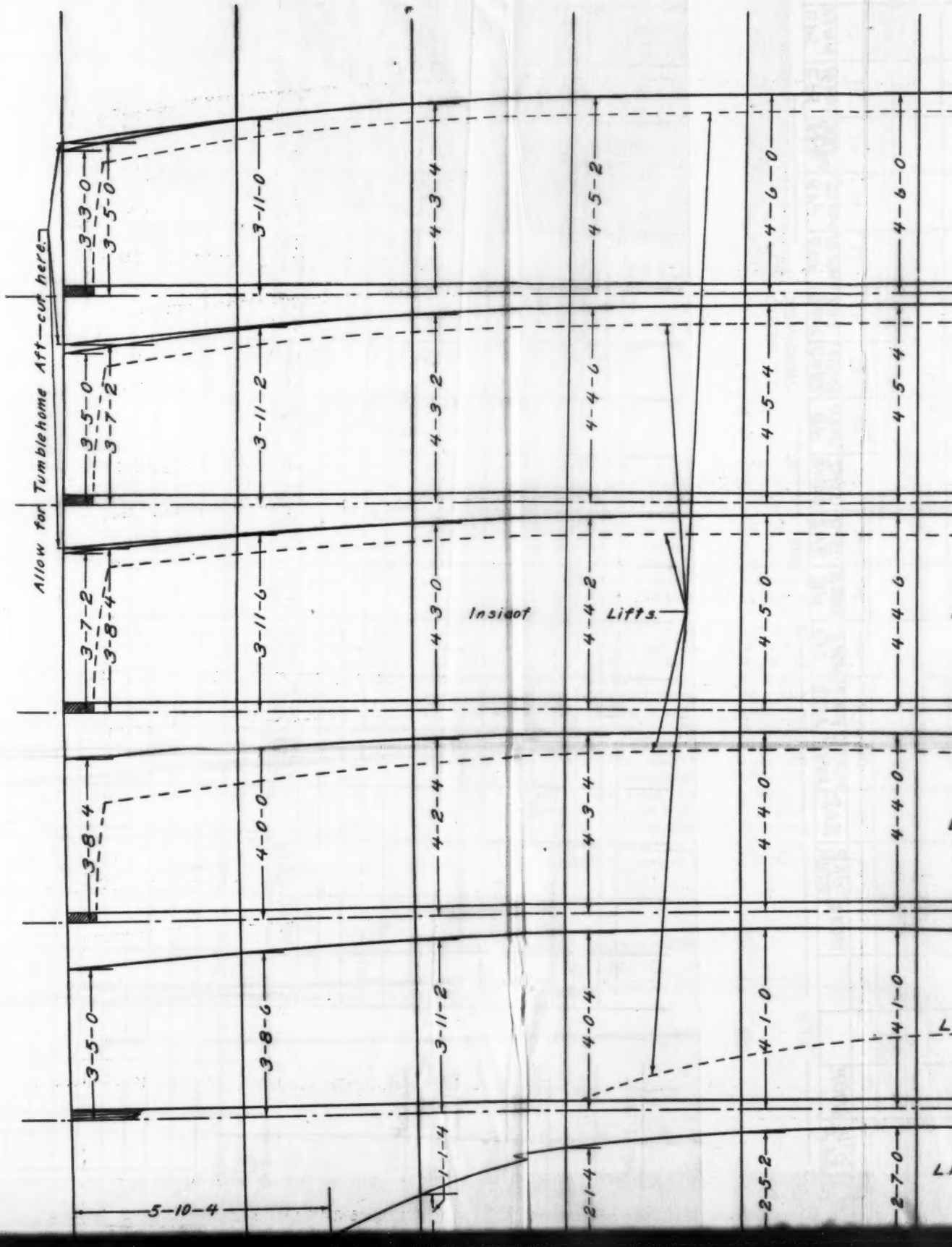


FIG. 2. PROFILE OF 30-IN. MODEL CRUISER


Allow for Tumblehome Aft—cut here.
3-3-0
3-5-0
3-11-0
4-3-4
4-5-2
4-6-0
4-6-0
3-5-0
3-7-2
3-11-2
4-3-2
4-4-6
4-5-4
4-5-4
3-7-2
3-8-4
3-11-6
4-3-0
Inside of Lifts.
4-4-2
4-5-0
4-4-6
3-8-4
4-0-0
4-2-4
4-3-4
4-4-0
4-4-0
3-5-0
3-8-6
3-11-2
4-0-4
4-1-0
4-1-0
1-1-4
2-1-4
2-5-2
2-7-0
5-10-4

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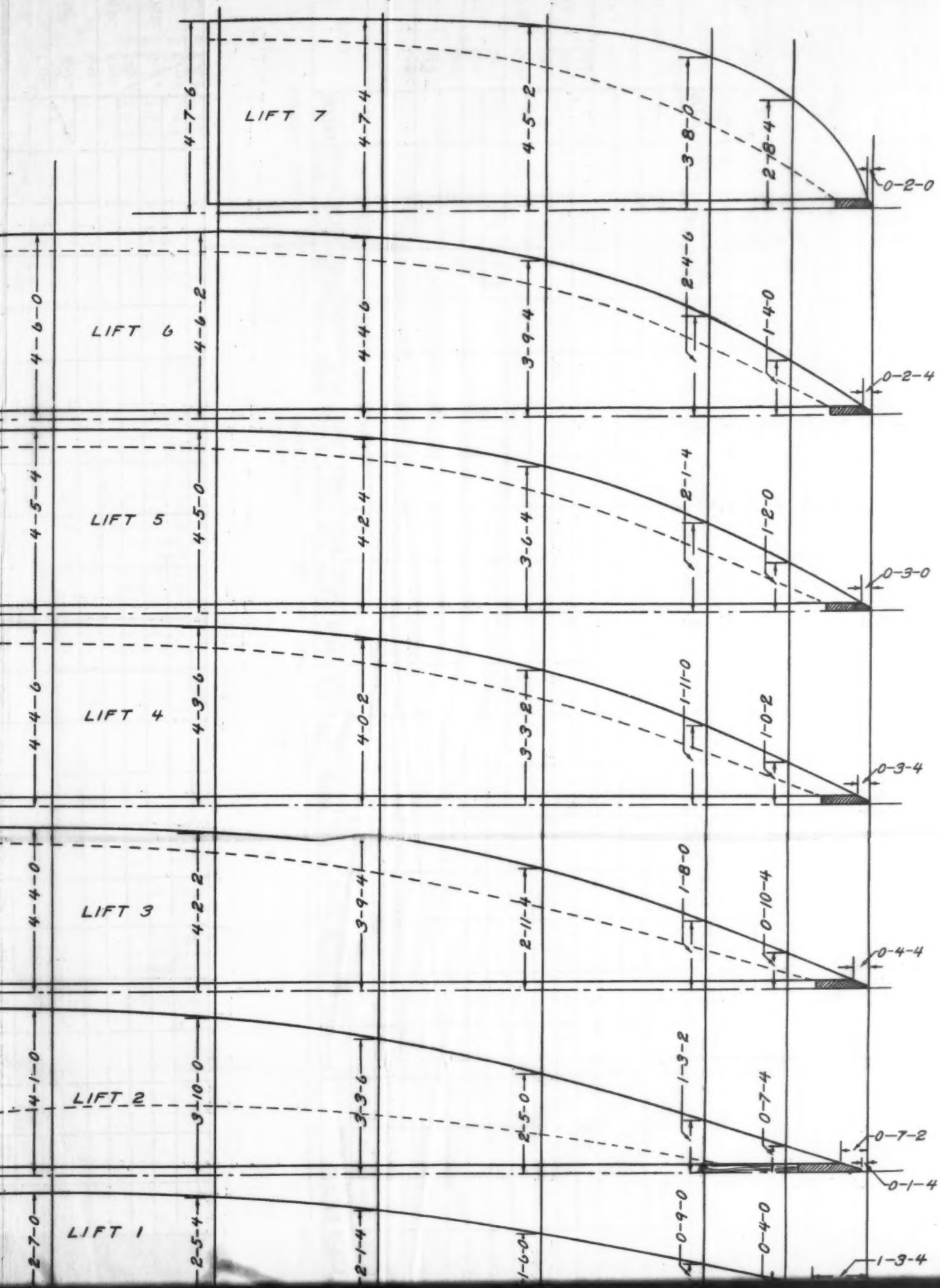
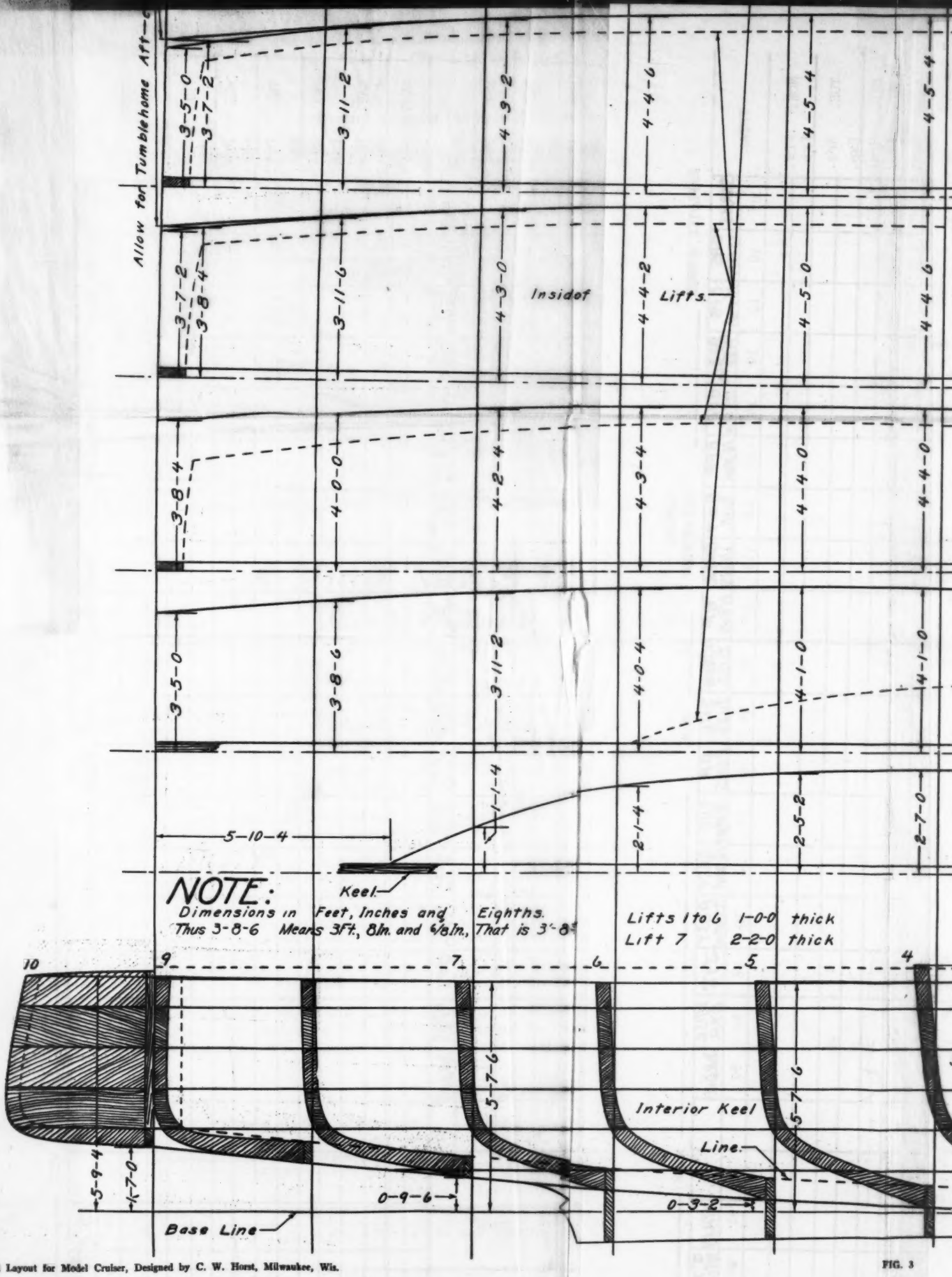




Hull Layout for Model Cruiser, Designed by C. W. Horst, Milwaukee, Wis.

FIG. 3

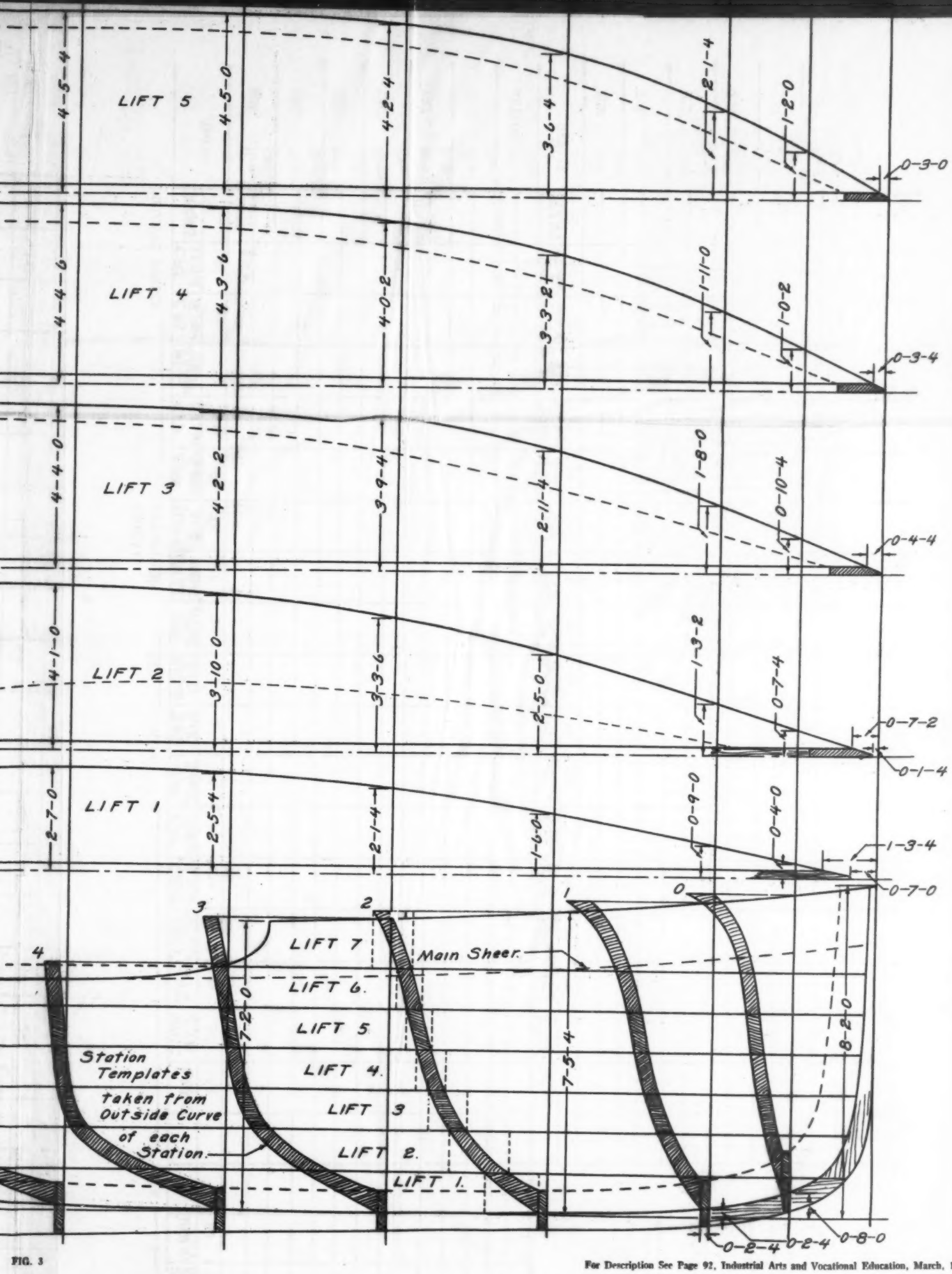


FIG. 3

For Description See Page 92, Industrial Arts and Vocational Education, March, 1931

squeezed out when the clamps are applied. Figure 6 shows the interior and the exterior of the glued-up halves in the rough after the clamps have been removed.

Lift 7 is then glued in place. Then make the exterior templates for the various stations shown in the drawings (see Fig. 3, Supplement No. 206), and cut off the surplus material and shape the hull according to the top curve of

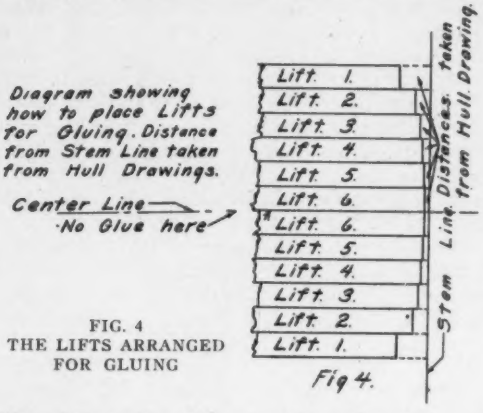
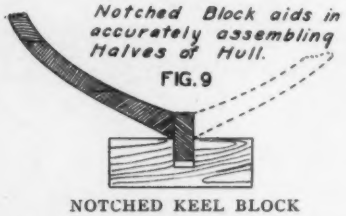


FIG. 4
THE LIFTS ARRANGED FOR GLUING

each lift and the various station templates. The stations must be marked on the hull so that the templates can be applied at the right places.

When the two halves are finished as shown in Figure 7A, the next step is to glue the backbone (consisting of the stem, the keel, and the stern member) in place to either half, as shown in Figure 7B. This may be done as shown here and the surplus material dressed off later, when the two halves have been glued together, as shown in Figure 8. Great care must be taken in gluing the two halves together. Two notched blocks are fitted rather tightly to the keel, one forward and the other aft, to make possible the accurate placing together of the two halves (Fig. 9). The inside of the hull should be given a coat of paint before the decks are put on. The deck beams are made of ¼ by ¾-in. pine, crowned in the center and notched in.



NOTCHED KEEL BLOCK

The decks of this model are of ⅛-in. mahogany, but any hard wood of that thickness is satisfactory. The decks are cut to extend over the boat ⅛ in. all around, as shown in Figure 10, to simulate the guards of the full-sized boat. It will be found advisable to put the raised forward decks on first, and then work aft. Before they are fastened down, the decks must be cut to permit the placing of the cabins. The underside should be given a coat of varnish to keep out the moisture and prevent warping. When the decks have been fastened down carefully and given their first coat of varnish, they may be lined with a ruling pen and India ink, as shown in Figure 10, to resemble actual planking.

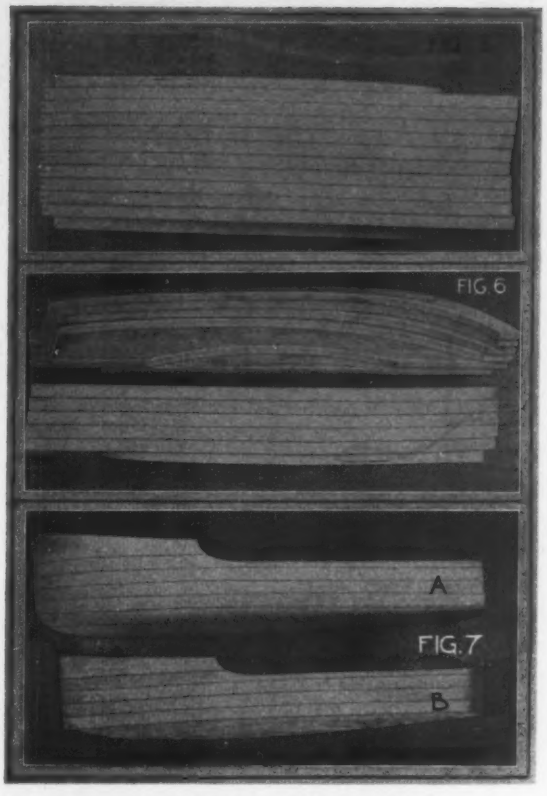


FIG. 5. THE LIFTS READY FOR THE CLAMPS.
FIG. 6. TWO HALVES OF THE HULL IN THE ROUGH.
FIG. 7. HALVES OF THE HULL WITH BACKBONE GLUED TO ONE.

The deck houses require accurate workmanship and a great deal of patience. Figures 11 and 12 show the details of construction. The various pieces are worked out and assembled in the order shown. The bridge-deck house must fit to slip into the deck opening. If the model is to have a power plant, both cabins must be made to lift off and on. The whole job may be fastened with glue. Figure 13 shows the use of improvised clamps during the gluing process.

Figures 11 and 14 show the construction of the trunk cabin. It is simpler to make, as only the ends must fit accurately into the deck opening. If the "crown," or curve in the top, seems too severe for wood, a piece of 30-gauge tin may be used, as it was, with excellent results, on the model shown. The tin must be cut to fit perfectly before it is fastened on, as, of course, it cannot be planed off as wood can.

The tops of both cabins may be given a realistic canvas effect by the use of muslin cloth shellacked on with orange shellac.

If portholes in the hull are desired, they may be drawn on with a compass and India drawing ink.

All, or only a few, of the fittings for the decks and the deck houses may be made as one's patience and enthusiasm dictate. All the deck fixtures may be made of wood. Those ordinarily of metal can be painted with aluminum or gilt paint to increase the realistic effect.

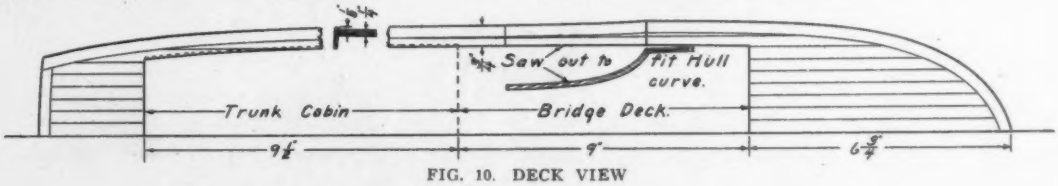


FIG. 10. DECK VIEW

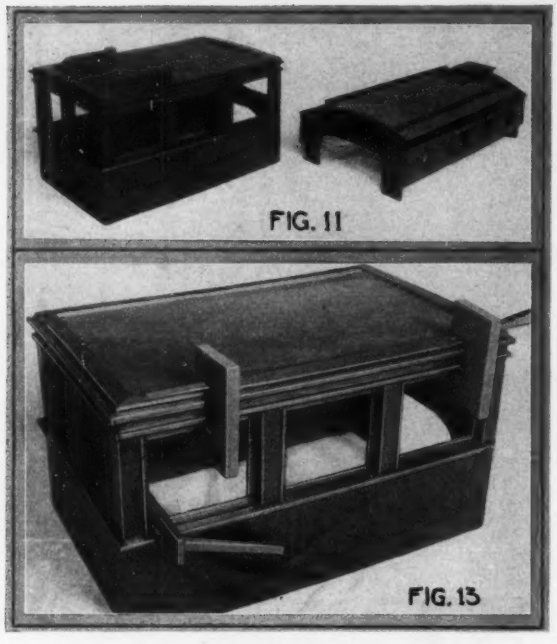


FIG. 11. DECK HOUSES.
FIG. 13. IMPROVED CLAMPS IN USE.

A 6-volt electric motor using flashlight batteries makes a good power plant. An automobile-horn motor serves very well for this purpose and is cheaply and easily obtained.

One-eighth inch cold-rolled steel makes a good shaft, and ¼-in. copper tubing serves well as a shaft tube. It is advisable to have the tube long enough to extend above the water line as that will prevent leaking around the shaft. Before the shaft tube is installed, plug both ends with solder and then drill a ⅛-in. hole at each end for the shaft to pass through. The solder will serve as a bearing at each end and allow the rest of the shaft to run free. In this way a great deal of friction is eliminated.

The strut may be made of 24-gauge tin and bent as shown in Figure 15. Great care must be taken to line the strut up with the shaft. A good way is to put the shaft in the tube and then slip the strut on and push it up until it strikes the hull. If the angle is not quite right, continue to adjust it until it fits perfectly. This is important, as too much power will be lost through friction if the strut does not fit properly.

As the boat may be "trimmed," or balanced, with the batteries, the electrical motor ought to be placed well forward, to cut down the shaft angle. Two or three inches forward of amidships will be about right. To simplify the problem of installation and alignment, the shaft may be attached to the motor by a small spring having the same inside diameter as the shaft. A drop of solder at each end will complete the fastening.

Satisfactory propellers are rather hard to make and since

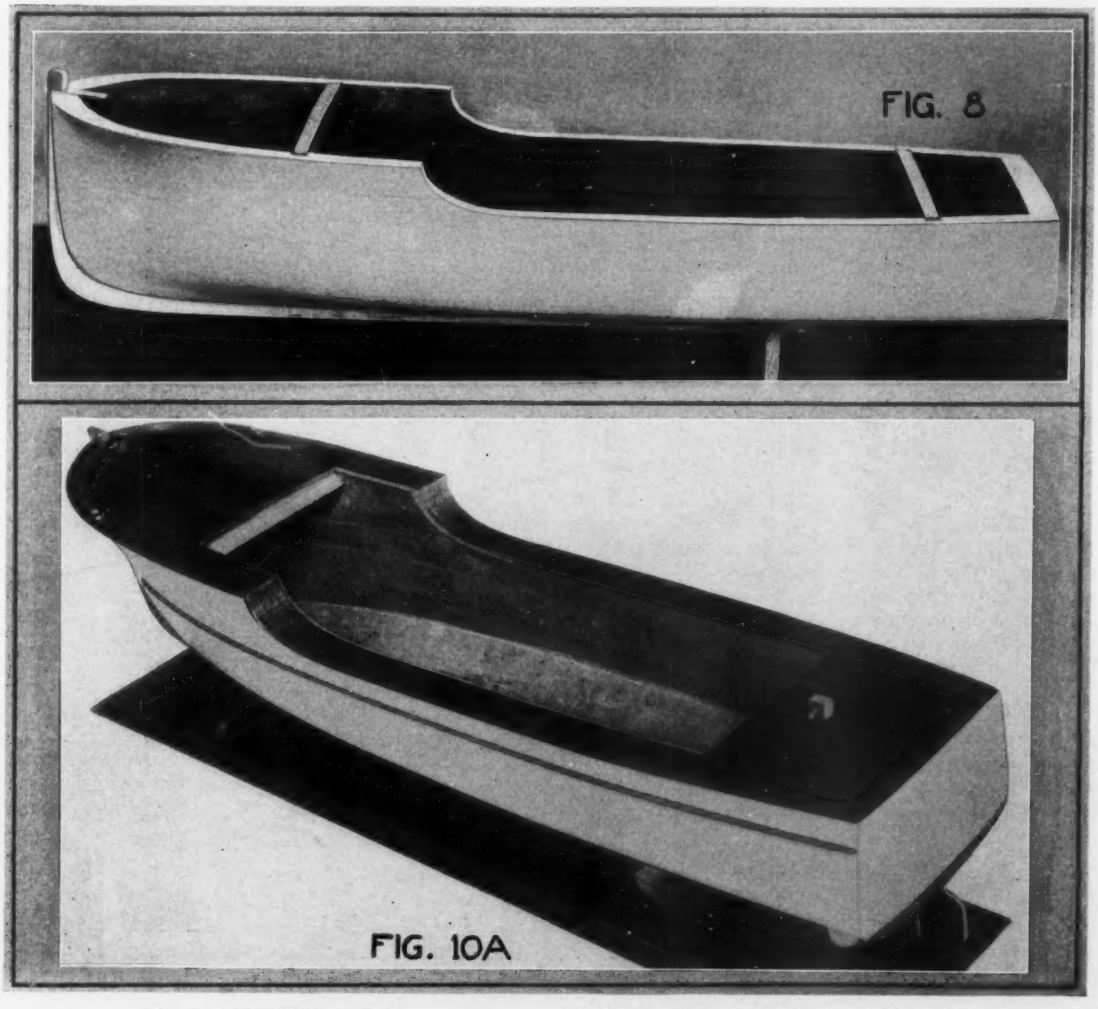


FIG. 8. ASSEMBLED HULL.

FIG. 10A. HULL WITH DECK IN PLACE.

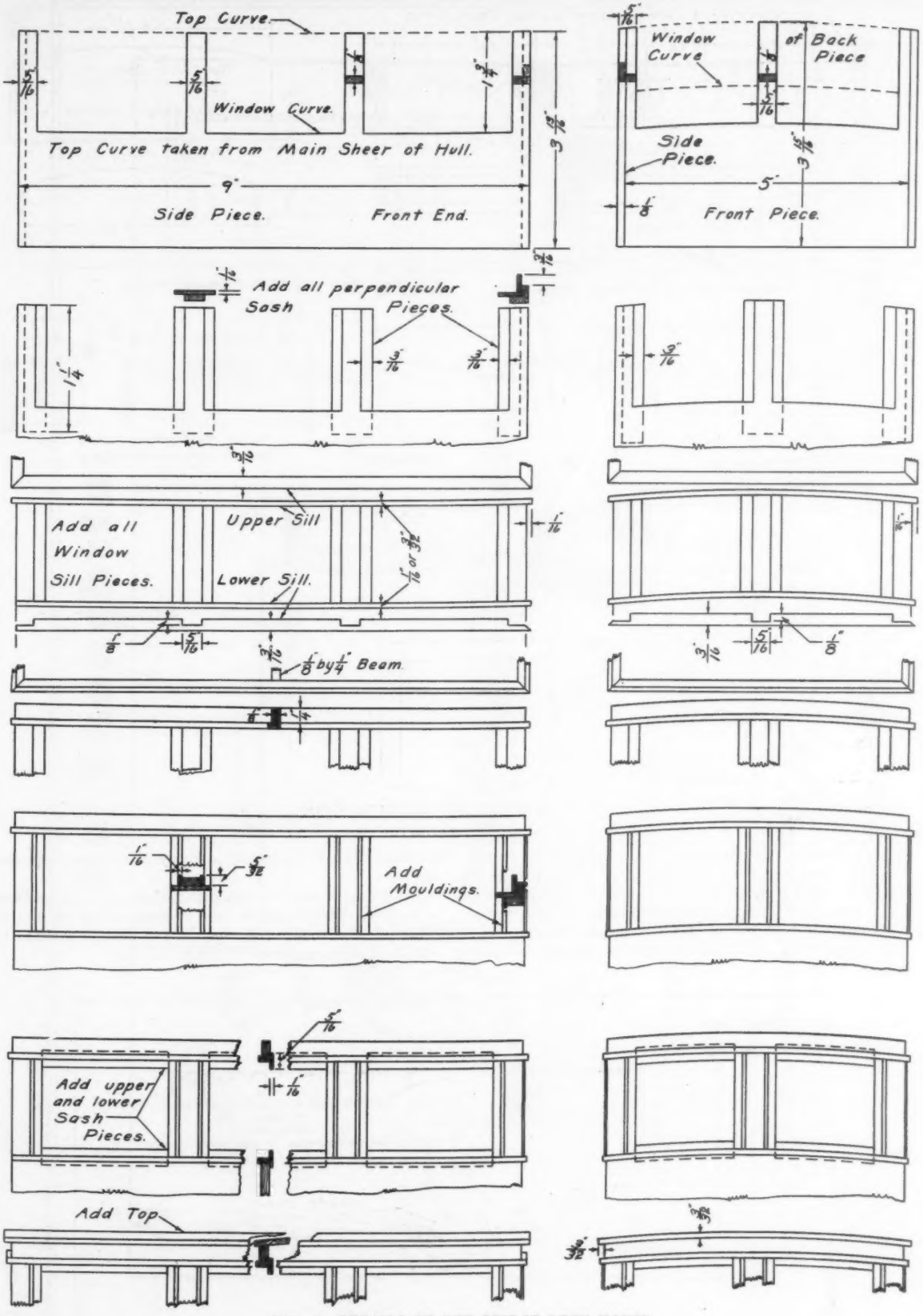


FIG. 12. DETAILS OF THE BRIDGE DECK HOUSE

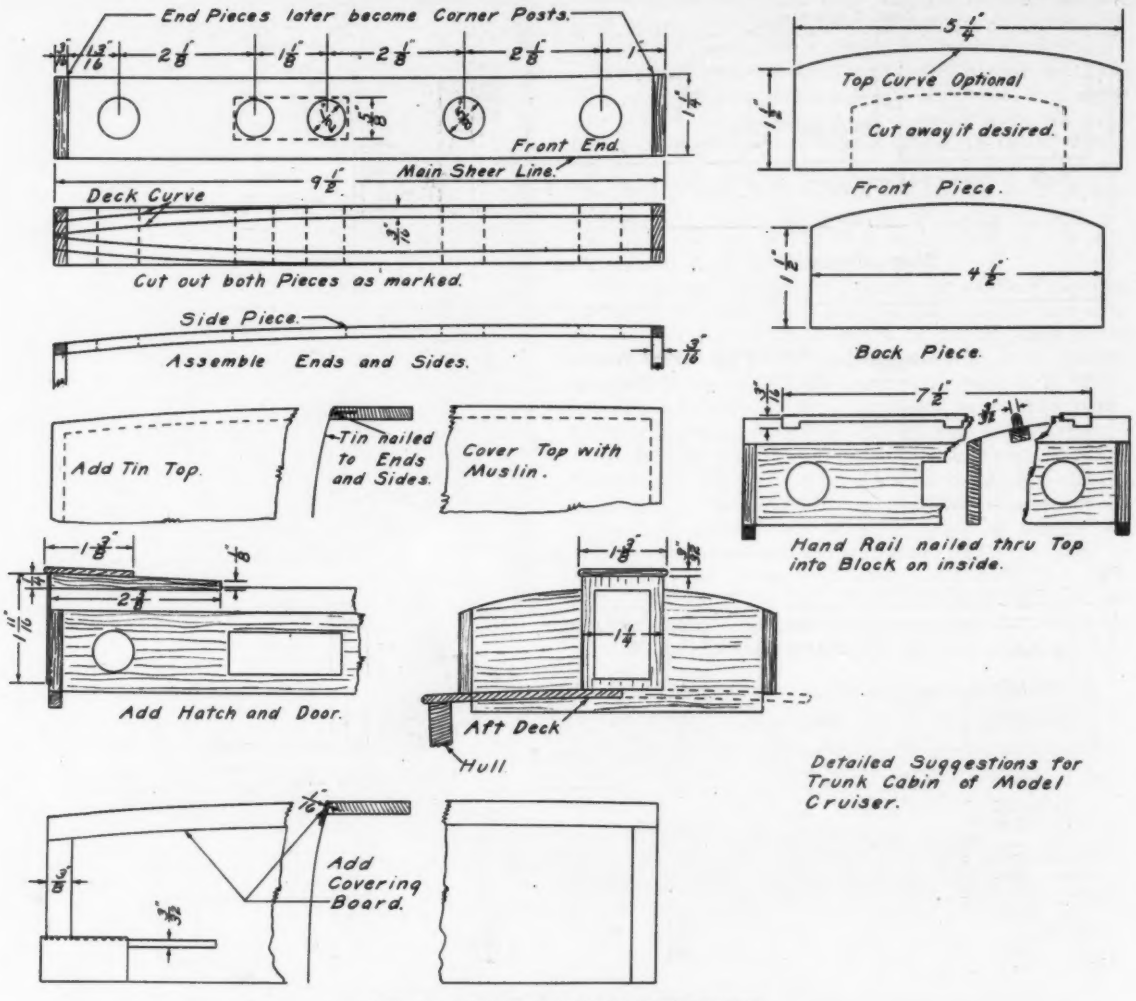


FIG. 14. DETAILS OF THE TRUNK CABIN

they cost only about 50 cents, it is usually better to buy one. The proper size for this model is about 2¼ in. in diameter with a 4-in. pitch. When ordering, specify whether a right-hand or a left-hand propeller is wanted. Looking forward from the back end of the boat a clockwise rotation is called right-hand and counter-clockwise rotation is called left-hand. This is important, as many motors run only one way.

The rudder is made of two pieces of 30-gauge tin soldered to a ⅜-in. rudder stem. It may be hung on the aft end of the boat, or a rudder tube may be put through the hull to hold the rudder, as shown in Figure 15.

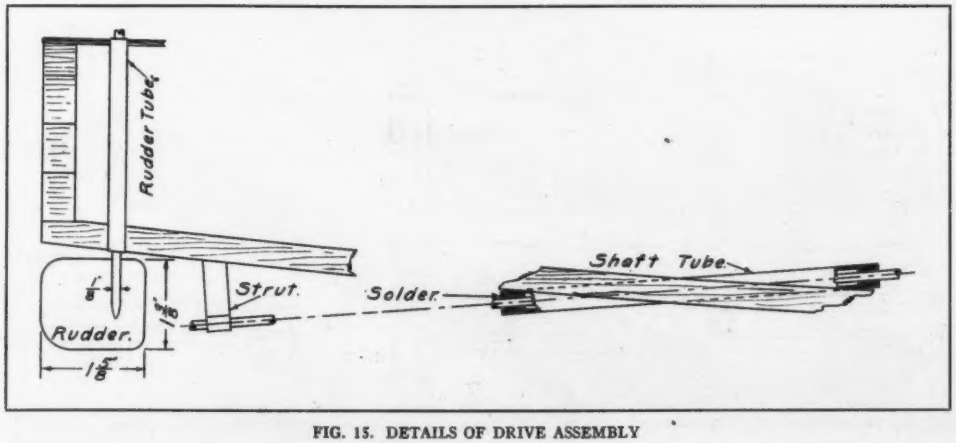
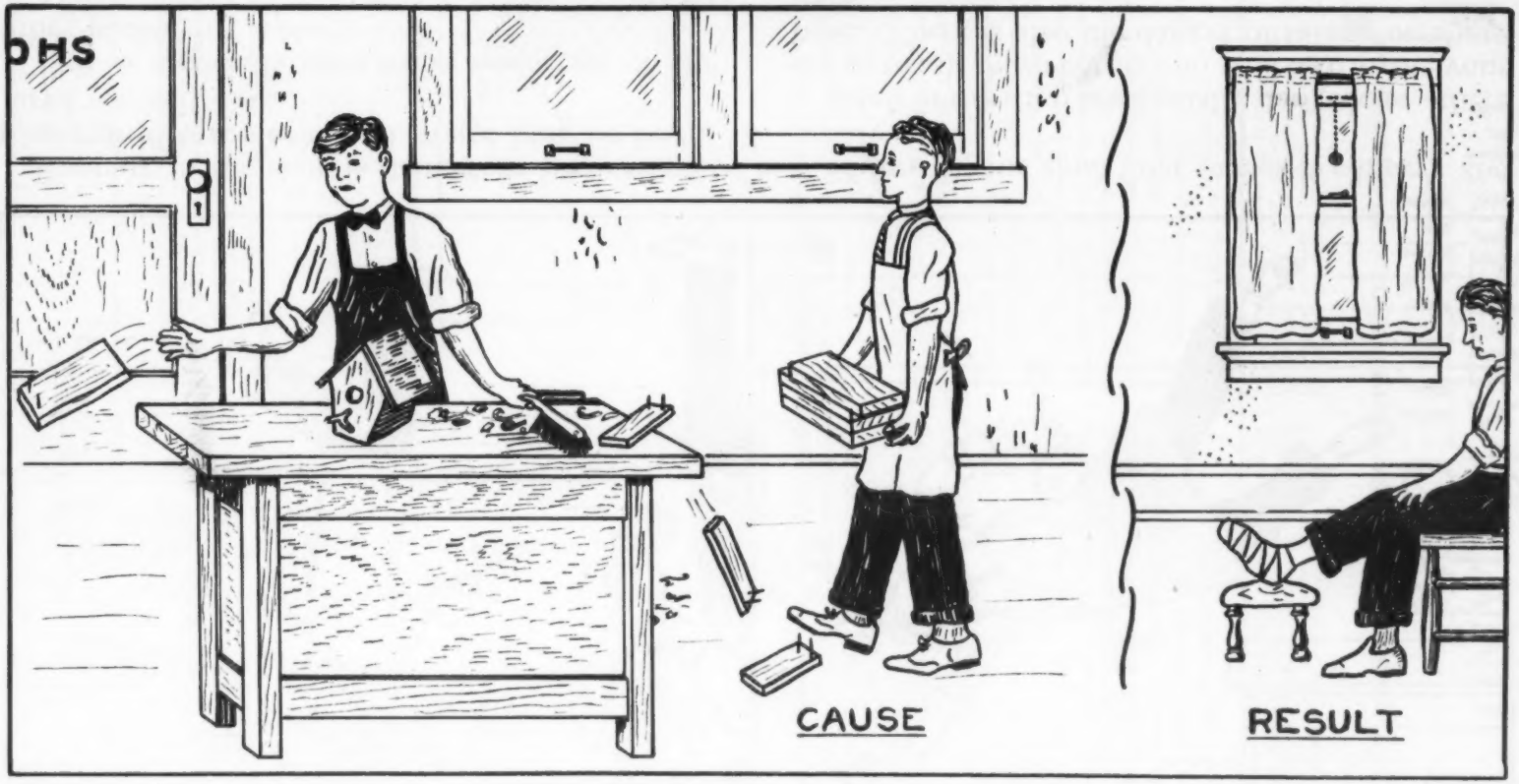


FIG. 15. DETAILS OF DRIVE ASSEMBLY

Be Thoughtful



The boy at the bench is resourceful — he is using an empty box to build a birdhouse.

He is thoughtless, too. Notice how he throws the left-over pieces, with nails sticking through, on the floor.

Nails should always be removed from scrap wood, otherwise someone may step on them and be badly hurt.

Such foot injuries are painful and often require days for healing.

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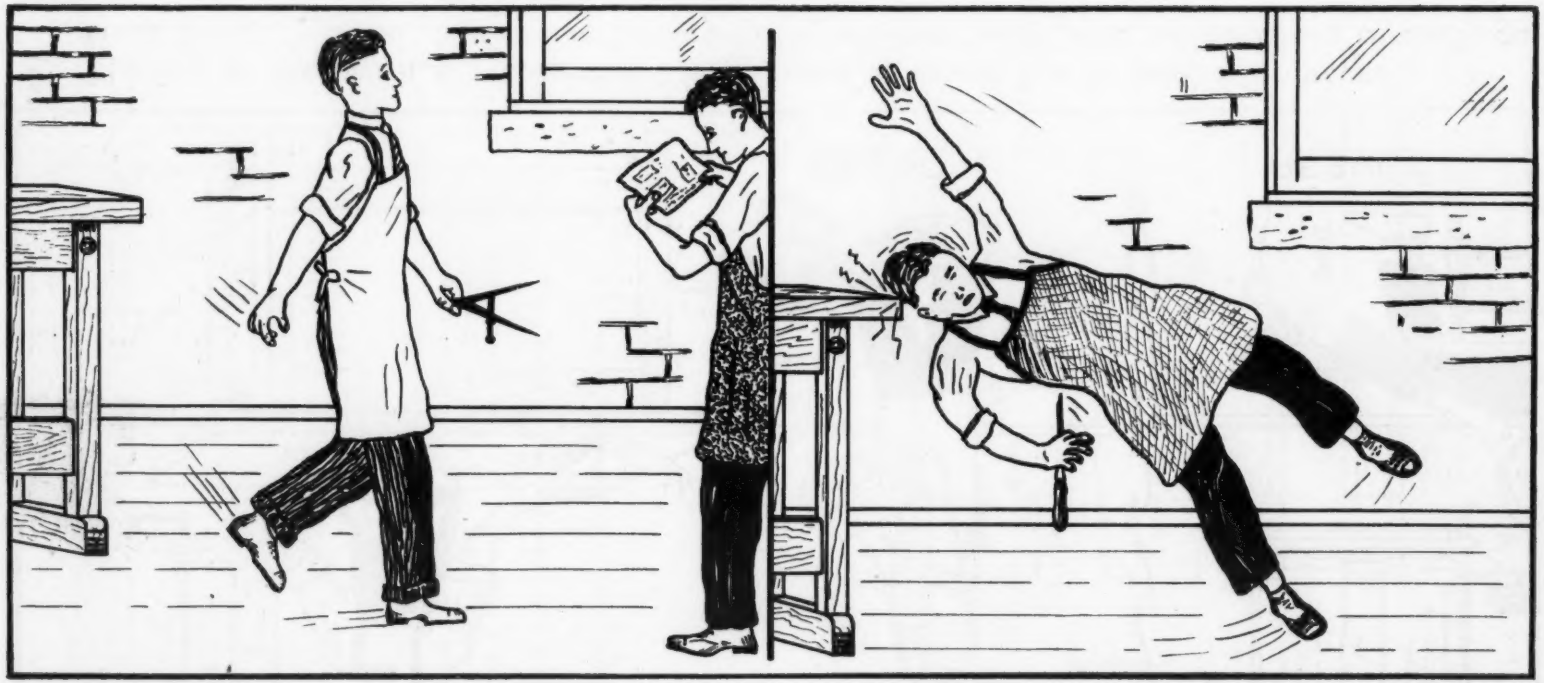
Submitted by Jos. J. Lukowitz, Milwaukee, Wisconsin

Watch Your Step



Running in the shop is dangerous because you may run into someone and injure him, or be injured yourself.

This is especially dangerous when one or the other is carrying a sharp tool.

Always carry tools with the points or cutting edge down. Do not run — watch your step.

Sliding on the shop floor makes it slippery and unsafe.

A fall in the shop is especially dangerous—there are so many sharp corners on which to strike your head. There is also the danger of falling on sharp tools.

Do not slide — watch your step.

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Submitted by Jos. J. Lukowitz, Milwaukee, Wisconsin

PROBLEMS AND PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts and Vocational Education. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in woodworking, turning, patternmaking, machine-shop practice, sheet-metal work, forging, foundry work, auto mechanics, auto electricity, electricity, architectural and mechanical drafting, printing, bookbinding, concrete work, farm mechanics, home mechanics, and other lines of industrial-arts work are desired for consideration.

A BOOK END

Carl v. Lindeman, Western State Teachers College, Paw Paw, Michigan

A very attractive and novel book end is shown in the accompanying illustration. The book end represents several books placed one on top of the other. Each book is constructed separately out of white pine or any other kind of soft wood glued together to make the size required. The stock is squared and one edge is rounded to form the back end of the book. The two ends must be grooved in and made rough with a backsaw to represent the pages.

The top book marked A may be made in a box form and the top hinged, thereby providing a storage space for paper or stamps. The complete project, if made of pine, may be lacquered in a blue color and sprayed with rose. The ends of the books may be gilded. For a variation, these book ends may also be polychromed.

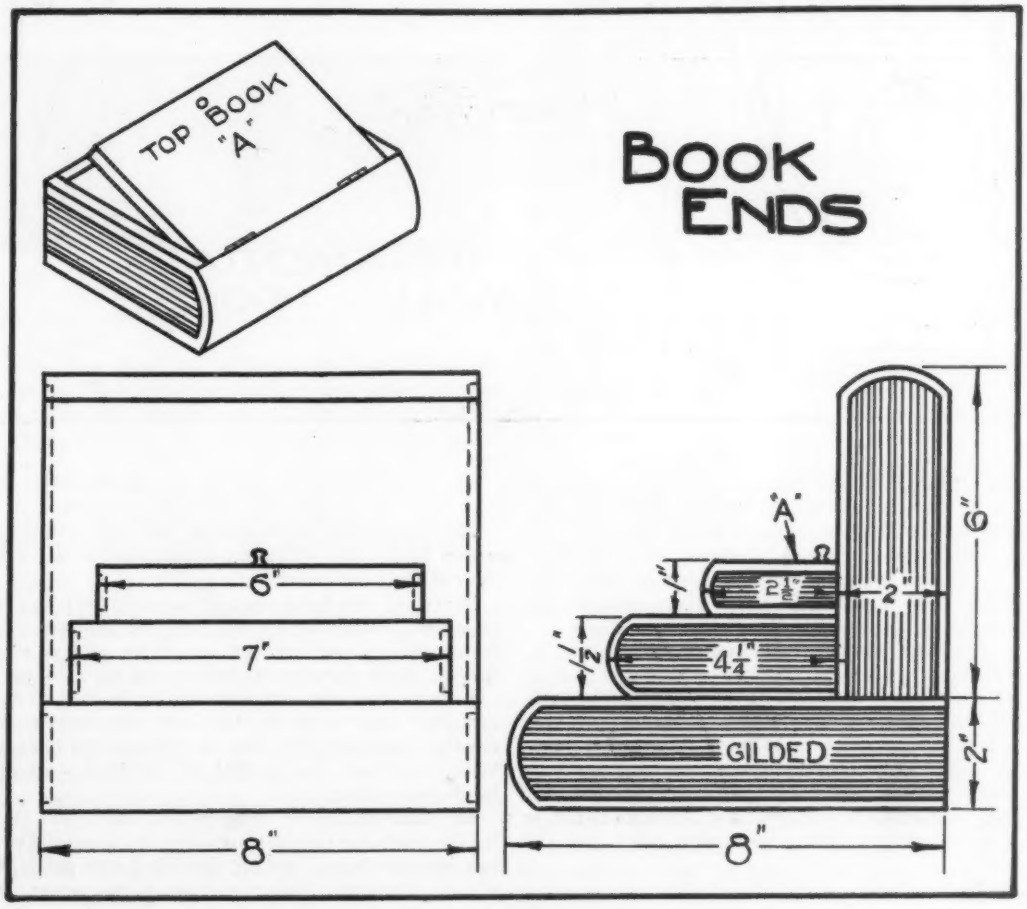
ORNAMENTAL WALL HOOKS

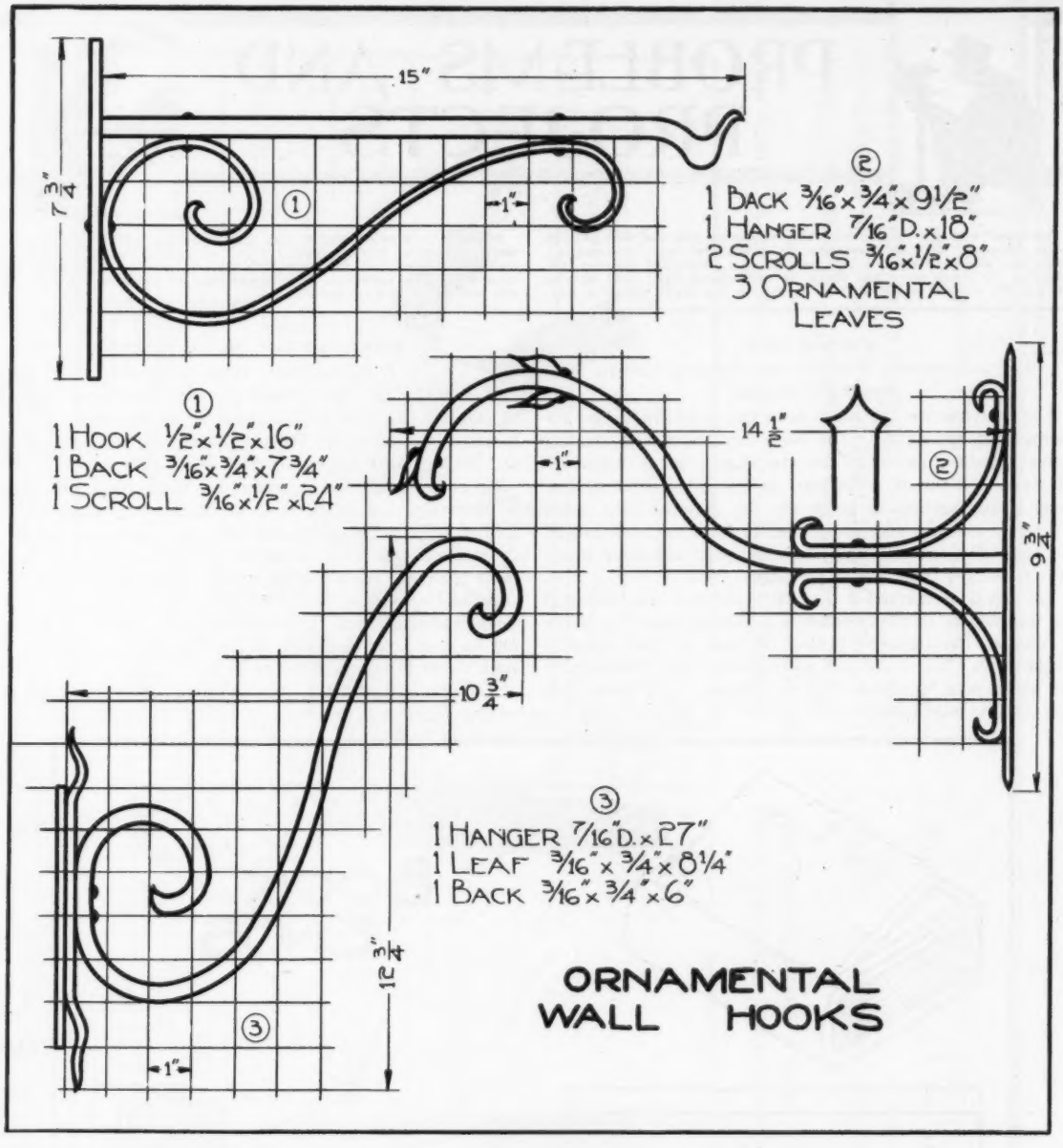
J. W. Bollinger, Tulsa, Oklahoma

Wall hooks, like those shown herewith, can be used indoors to support canary or parrot cages, or on the front porch or in the conservatory for hanging baskets. Design No. 3 also can be used for a lantern or other porch-light fixture.

To make design No. 1, turn or file about ⅜ in. of one end of the square iron down to ¼ in. in diameter. Draw a taper on two sides of the other end and shape the hook. Drill and countersink a hole in the piece for the back, and rivet the parts together. Make a drawing of the scroll ornament on a piece of tin or galvanized iron, using the squares as a guide. Shape the scroll with the help of a scroll former, in a bending fork, or over the anvil. Rivet it in place, using countersunk rivets to fasten it to the back.

To make design No. 2, turn or file about ⅜ in. of one end of the round iron down to ¼ in. in diameter, and draw a





short taper on the other end. Make a full-sized drawing of the hook and the scrolls. Bend the hook to shape over the anvil, using the layout as a guide. Rivet the hook to the back. Shape the scrolls with ends as shown, and rivet them in place. Cut the ornamental leaves out of No. 24 sheet iron, and rivet them in place with ⅛-in. rivets. Make marks on the leaves to represent veins with a blunt-edged cold chisel.

Make a full-sized drawing of design No. 3 on a piece of tin or galvanized iron. Shape the scroll with the help of a scroll former, or a bending fork, or over the anvil. The back consists of two pieces, one being hammered out on each end to resemble a leaf. Marks may be made to represent veins with a blunt-edged cold chisel.

The completed wall hooks will look well finished in flat black paint; they may also be enameled or lacquered to match the color of the cage or hanging basket with which they are to be used.

35-AMPERE, 110-VOLT LOAD BOX

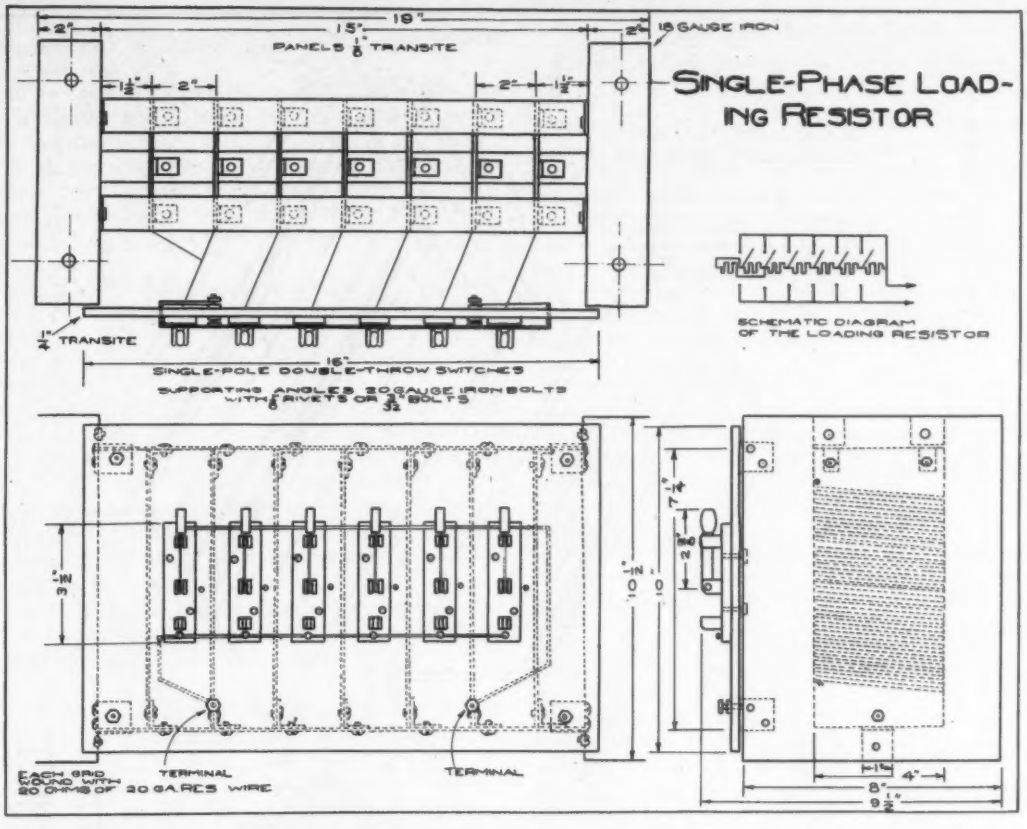
R. H. Ingersoll, Riverside, California

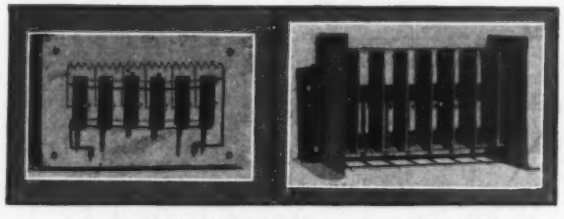
The illustrations accompanying this article will perhaps explain better than words, the construction of a very useful piece of shop equipment.

Our school shop had a very definite need for a light-weight, convenient, loading device that could be used for load testing of various machines and equipment, and as a current limiting device for electric furnace and arc-light work.

Since the necessary materials were in the shop, it was comparatively easy to design and build this very serviceable piece of apparatus. We plan on building two more of this same design next year so that we can have a set of three for 3-phase testing.

The front panel is of transite ¼-in. thick, and the plates for the resistance elements are of ⅛-in. transite. The SPDT switches are Circle T battery size. On future panels we plan





FRONT AND REAR VIEWS OF THE LOAD BOX

to secure these switches in the back so as to improve the front of the panel.

The front view shows the wiring diagram painted on the transite panel. This helps the student in tracing out the circuit but does not explain what we did with the seventh element when there are only six switches. The answer is, as shown in the blue print, that we connected two of the elements in parallel on one switch.

A FARMSHOP FILING CABINET

Eugene C. Graham, Kansas State Agricultural College, Manhattan, Kansas

I. The Purpose of this Project

In all Smith-Hughes departments teaching vocational agriculture and shopwork there is a real need for one or more filing cabinets for bulletins, catalogs, and records. Every farmer could use one of these cabinets to file papers, catalogs, or records.

II. Material and Cost

The cost of the material for this cabinet will vary in different towns but should not exceed $3.50.

For one cabinet, as illustrated, the bill of material is as follows:

1 pc. 3-ply panel ¼" x 24" x 5' — fir
7 pc. beaded ceiling or flooring — ⅝ or 13/16 x 3¼" x 8' — fir or yellow pine
2 pc. flooring 13/16" x 3¼" x 10' — fir or yellow pine
2 pc. board ½" x 12" x 12' — white pine or gum
2 pc. board ¼" x 2½" x 24" — pine or gum (may be ripped from 1 pc. 13/16" thick)
1 doz. ½" No. 8 f.h.b. screws
2 doz. ⅜" No. 6 corrugated fasteners
½ lb. 1½" No. 15 wire brads (or 6d finishing nails)
½ lb. 1" No. 16 wire brads
1 pc. galvanized iron 1" x 12" — 16 gauge
3 antique-copper drawer pulls

III. Tools

Plane; crosscut saw; ripsaw; steel square; try-square; rule; marking gauge; brace; hammer; screw driver; ⅝-in. wood bit; 3/16-in. drill; hand drill or breast drill; chisel; countersink; nail set.

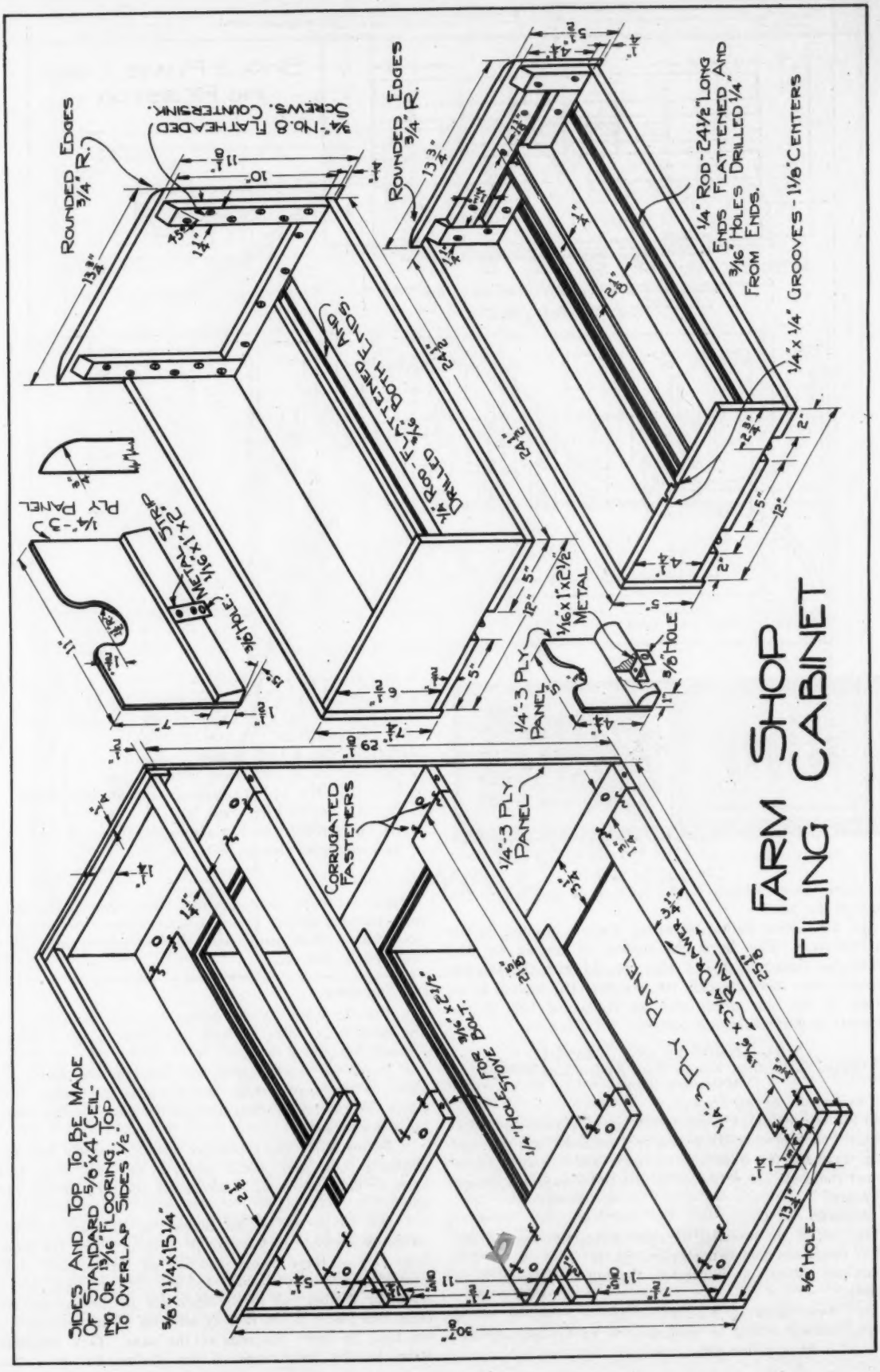
IV. Procedure

1. Cut the stock for the drawer supports or shelves. You will need 6 pc. 21⅝ in. long and 6 pc. 13¼ in. long — finished dimensions.

2. Notch the shorter pieces with crosscut saw, ripsaw, and chisel on the grooved edge and plane off the tongue on all pieces. Be careful to plane and saw all pieces square and to exact dimensions.

3. Fasten these parts together with corrugated fasteners, placing a ¼-in. panel in the center of one shelf. Bore ⅝-in. holes as indicated in each corner for the nuts of the stove bolts.

4. Cut 16 pc. of beaded ceiling (or flooring, if heavier cabinet is desired) to a length of 30⅞ in. Plane the groove from two of these pieces, and lay off the location of the shelves on one side of each, 1¼ in., 12⅞ in., and 24½ in. from the bottom end to the underside of the shelves. Nail these two pieces to the shelves, allowing ¼ in. projection at the back to cover the edge of the panel. Tack temporary strips to the front ends of the shelves to space them


FARM SHOP
FILING CABINET
SIDES AND TOP TO BE MADE OF STANDARD 5/6 x 4 CEILING OR 13/16" FLOORING. TOP TO OVERLAP SIDES 1/2".
5/6 x 11 1/4 x 15 1/4"
CORRUGATED FASTENERS
1/4"-3 PLY PANEL
1/4"-3 PLY PAD PANEL
1/4" HOLE FOR BOLT.
5/6" HOLE
1/4"-3 PLY PANEL
1/16 x 1" x 2 1/2" METAL
1/4" ROD - 24 1/2" LONG ENDS FLATTENED AND 3/16" HOLES DRILLED 1/4" FROM ENDS.
1/4" x 1/4" GROOVES - 1 1/8" CENTERS
ROUNDED EDGES 3/4" R.
3/4"-NO. 8 FLATHEADED SCREWS. COUNTERSINK.
DRILLED ROD - FLATTENED ENDS AND BOTH ENDS.
PLY PANEL
1/16 x 1" x 2 1/2" STRIP
PANEL
5/16" HOLE.

properly, and tack a diagonal brace on one side to hold shelves square with sides.

5. Nail on one side keeping the matched boards tight and testing frequently with a square to keep the sides square with the shelves.

6. Nail on the other side in the same way and plane off the tongues from the edges of the last boards.

7. Bore 3/16-in. holes to the center of the ⅝-in. holes for the stove bolts and put these in place. Set all the brads with a nail set.

8. Fasten 1¼-in. drawer guides in place with 1-in. brads and a little Le Page's glue. Place them exactly 7½ in. above the shelves.

9. Build in the frame to support the top, fastening with brads and glue.

10. Cut and fit the back panel, nailing it in place with brads. Test all angles with a try-square before nailing.

11. Cut five pieces of ceiling (or flooring) for the top and nail them in place allowing ½-in. overhang on each side.

12. Cut out and plane the stock for the drawers. Do not round the ends and sides of the drawer front until the cleats are screwed in place. Use a sharp block plane for rounding edges and ends.

13. Build drawers to dimensions. Be sure to raise the bottom of the drawers ¼ in. above the lower edge of the sides. Drawers should have at least ⅛ in. play to prevent sticking.

14. Cut 4 pc. of ¼-in. rod 25 in. long and flatten the ends after heating. Drill and countersink a 3/16-in. hole in each end.

15. Make separators for drawers and fasten in place on rods.

16. Use fine sandpaper to rub down cabinet and finish with shellac and varnish or with enamel paint as desired.

17. Fasten the drawer pulls in place after finishing.

JOB AND RECORD CARD

Chester A. Lyle, Instructor of Printing, McKinley High School, Canton, Ohio

The question of grading the student is of prime importance to every printing instructor, whether he is teaching the subject in the intermediate, high, prevocational, trade school, or university. The grades given should be accurate, and the old cry "too many in a class" should not be used as an excuse for inaccuracy, nor should the assertions "I do not have the time" absolve the teacher from making a daily record of the students' grades. Most instructors do not know the ability of all their students, and there are few instructors who can keep in their minds the accomplishment of their several students from day to day.

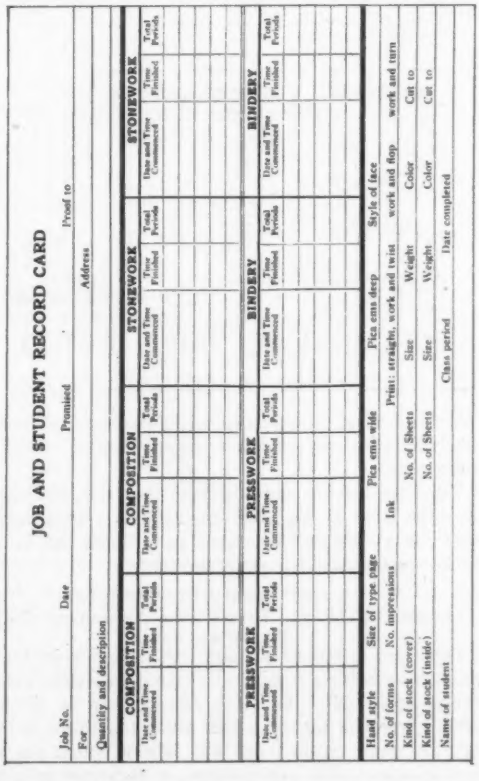
If printing in the school is to advance, the printing instructors *must have a record* of the grades of their students which is available at any time. Nor can the printing instructor excuse himself by comparing his methods of teaching with those used by the academic teacher. In the printshop, students are taught individually, while the academic teacher teaches his students collectively.

The time is here when the grading must show facts that may be used as guidance to future lessons, and the results of each individual's work should be evidenced by the grades which he has received.

Correct grading is a vital question, and if the student is to be fairly dealt with, grading systems must be developed that are workable and fair to all.

The form shown herewith under the caption "Job and Student Record Card," is used at McKinley High School printshop, Canton, Ohio. It has been developed solely for the advanced student who has had more than one and a half years of printing.

When an order for productive work is brought into the shop, the student receives one of these job and record cards which he fills out in detail. He keeps this card up-to-date



JOB AND STUDENT RECORD CARD

Job No. ____ Date ____ Promised ____ Proof to ____

For ____ Address ____

Quantity and description

COMPOSITION			STONEWORK		
Date and Time Commenced	Time Finished	Total Periods	Date and Time Commenced	Time Finished	Total Periods

PRESSWORK			BINDERY		
Date and Time Commenced	Time Finished	Total Periods	Date and Time Commenced	Time Finished	Total Periods

Head style ____ Size of type page ____ Pica ems wide ____ Pica ems deep ____ Style of face ____

No. of forms ____ No. impressions ____ Ink ____ Print: straight, work and twist ____ work and flop ____ work and turn ____

Kind of stock (cover) ____ No. of Sheets ____ Size ____ Weight ____ Color ____ Cut to ____

Kind of stock (inside) ____ No. of Sheets ____ Size ____ Weight ____ Color ____ Cut to ____

Name of student ____ Class period ____ Date completed ____

COMPOSITION			STONEWORK		
Date and Time Commenced	Time Finished	Total Periods	Date and Time Commenced	Time Finished	Total Periods

PRESSWORK			BINDERY		
Date and Time Commenced	Time Finished	Total Periods	Date and Time Commenced	Time Finished	Total Periods

COST SUMMARY

ITEMS	TIME H	TIME M	Hour Rate	COST
Composition				
Presswork				
Cutting				
Bindery				
Monotype				
Linotype				
Ink				
Stock — Cover				
Stock — Inside				
Cuts				
Total Cost				

FACE AND REVERSE SIDE OF RECORD CARD. ORIGINAL PRINTED ON AN 8 BY 5-IN. CARD

each day as regards date and time commenced and time finished under each operation until the order is completed. It will be noted that there are ten spaces (two school weeks) for the four major operations performed in a high-school printshop. This allows enough space for recording all the necessary time required for the average job.

On the reverse side of the card is found the cost summary which the student figures out and fills in completely. The basis for hourly rates is taken from the schedules of the United Typothetae of America.

If more than one student is working on the same job, each student has a job and record card. These cards should be kept on file throughout the school life of the student.

The card makes it possible to keep an accurate account of the time spent by a student on a job. It helps him develop speed and accuracy, and gives him a knowledge of the necessary steps required to finish a printed job. It also teaches him now to make out a job envelope. It eliminates all question as to responsibility for a particular job, instills new interest in the work, and gives the vocational director, or any other person interested, an insight into the student's work and ability. Finally, it gives the instructor a true guide for grading the work of each student.

METAL FLAG STAND

H. O. Jaeger, Moline, Illinois

The flag stand described herewith may be used to hold a flagpole or a Christmas tree. It is very easily made by any eighth-grade boy.

All metal, with the exception of the pipe, is ⅛ by ¾-in. mild steel.

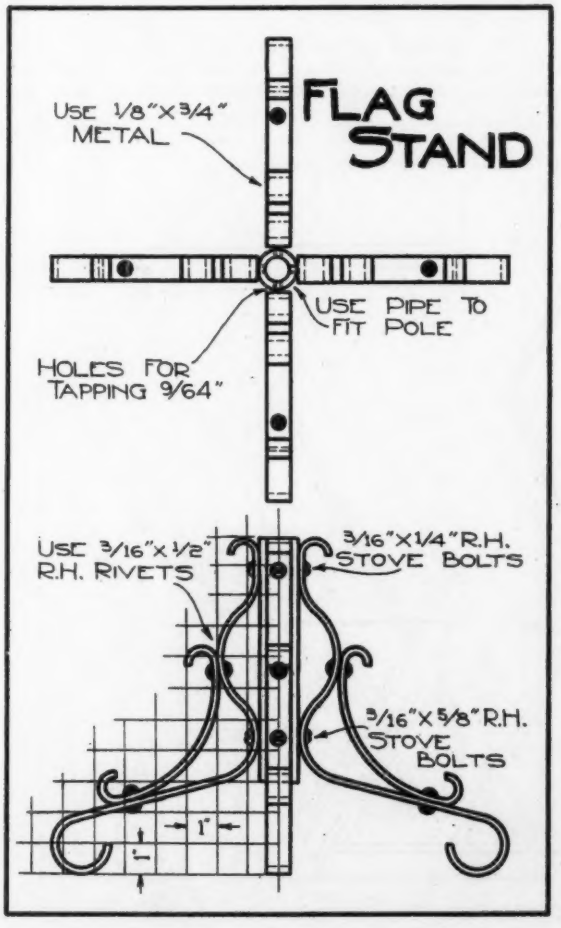
A layout of each piece is made, from which the required length of the pieces may be obtained. Cut pieces to length and bend them to the shape of the layout.

After all pieces have been bent, find the location of the bolt and rivet holes and punch or drill 13/64-in. holes. Assemble the braces and legs with 3/16-in. rivets.

Get a piece of pipe to fit the flagpole and locate all holes. The four upper holes are to be 1 in. from the top of the pipe, and the lower holes 6½ in. from the top. Drill 9/64-in. holes and then tap them for 3/16-in. stove bolts.

The bolts used in the upper part of the flag stand are to be flush with the inside of the pipe. The lower bolts extend into the pipe for the pole to rest on.

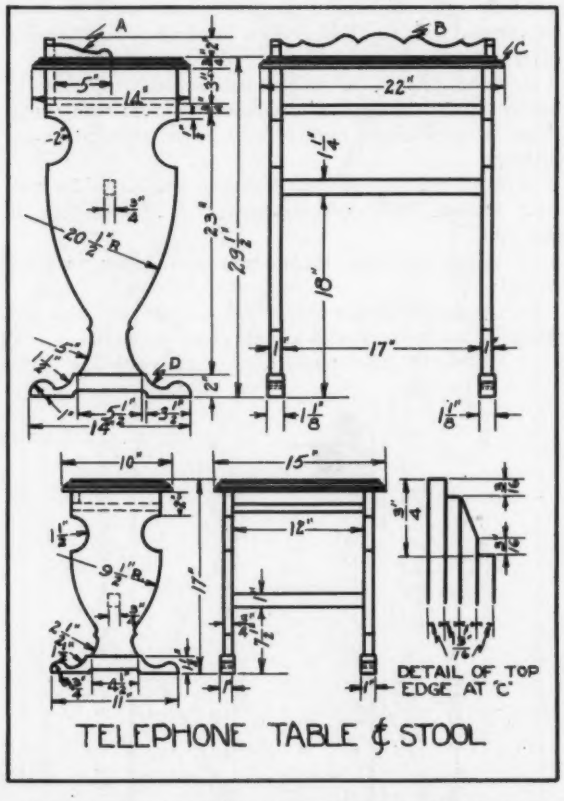
The flag stand may be finished with lacquer, applying two or three coats of a color to suit the student.



TELEPHONE TABLE AND STAND

Clarence A. Berg, Council Bluffs, Iowa

The project shown herewith is very popular. Both pieces are easy to make. With the exception of the base, which is mortised together, all the other parts are fastened with screws.



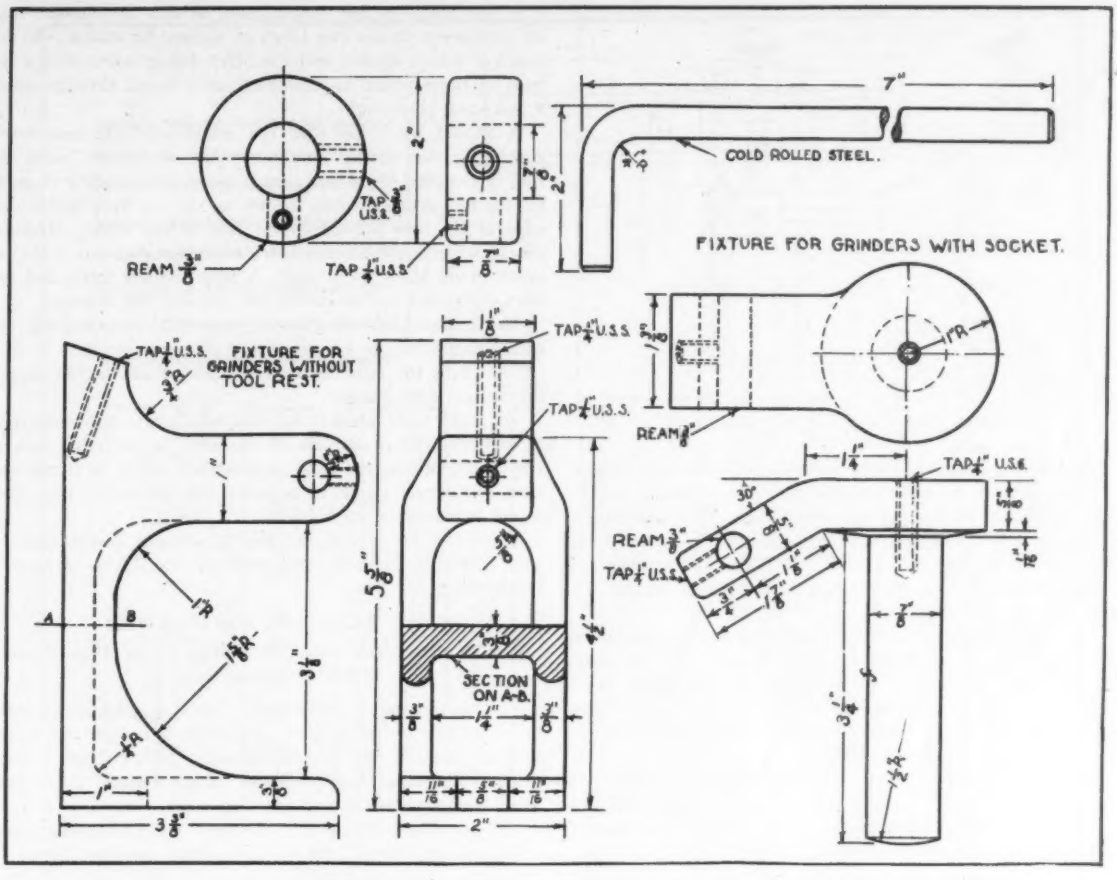
A and B may be designed to suit the taste of the student. Detail C is shown at the lower right-hand corner of the illustration.

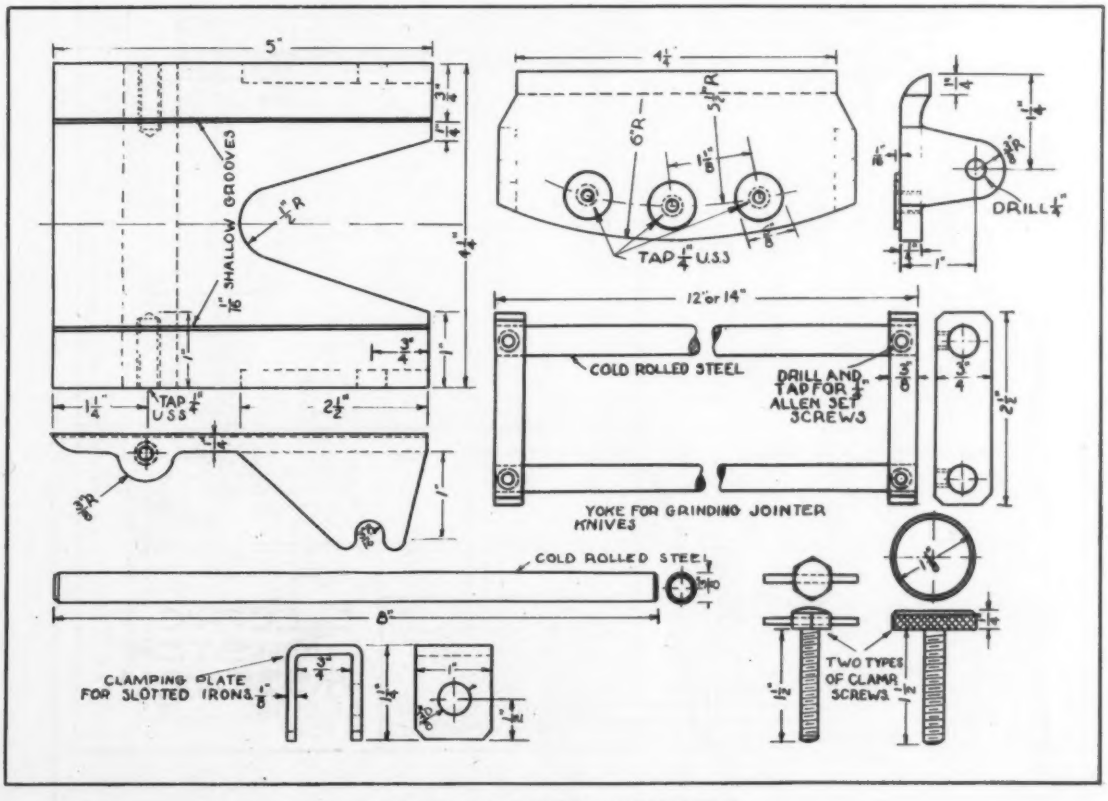
The stool has the same lines as the table and the seat is made the same as the table top. There is a little shelf on the stool for a notebook or memo pad. When not in use, the stool may be placed beneath the table.

A GRINDER ATTACHMENT

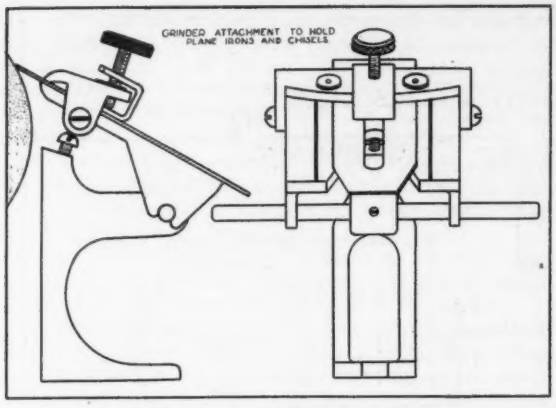
Eugene C. Graham, Kansas State Agricultural College, Manhattan, Kansas

There are a number of good tool grinders on the market which have holders designed to take plane irons, chisels, and similar tools. Most of these grinders are of the oilstone-grinder type and for the school which can afford to buy them they are quite satisfactory. With wheels which run at a low rate of speed they cut slowly but they are safe for boys to operate.





DETAILS OF GRINDER ATTACHMENT



ASSEMBLY OF GRINDER ATTACHMENT

For schools furnished with a small power bench grinder it is not difficult to make the patterns for a useful attachment which will fit many types of grinders. This attachment can be machined without expensive equipment. A few small holes drilled and tapped, a little filing and the attachment is ready for use. The writer has used this attachment for more than two years.

It is surprising what a range of grinding jobs can be done with this inexpensive outfit. Every size and make of plane iron, all sizes and kinds of wood chisels including skew chisels for wood turning, spokeshave cutters, and all of the smaller sizes of jointer knives from 4 to 10 in. in length can be ground quickly and accurately.

There is very little danger of overheating tools, and with a pan of water handy into which the edge of the tool can be dipped when it becomes a little warm, there is less danger than with tools held in the hand.

A few hints on the construction of this attachment may be of interest. It has two types of supporting stands, one for grinders with a socket, and the other for grinders with a flat base or those which are mounted on a bench through which a bolt may be placed.

It should be noted that the round-head machine screw supporting the sliding tool holder is only in use when the tool is removed from the clamp. When the grinding is going on, the tool grinder is free to slide on the rod with the beveled edge of the tool floating on the face of the wheel. Medium-coarse wheels, not too hard, are recommended and a No. 46 grain, grade M, is about right. A wheel with a rim speed less than 5,000 feet per minute is not running fast enough.

The jointer-knife attachment is a yoke with a guide rod long enough to take knives of any common length.

The plate for grinding slotted plane irons can be slipped into place very quickly.

To grind tools with a uniform bevel it is only necessary to measure the projection of the edge beyond the jaws of the clamp when the most satisfactory angle is found and then to instruct pupils to measure this projection each time a tool is placed in the holder.

Tools can be ground on this attachment faster than by hand grinding methods and with practically no danger of overheating.

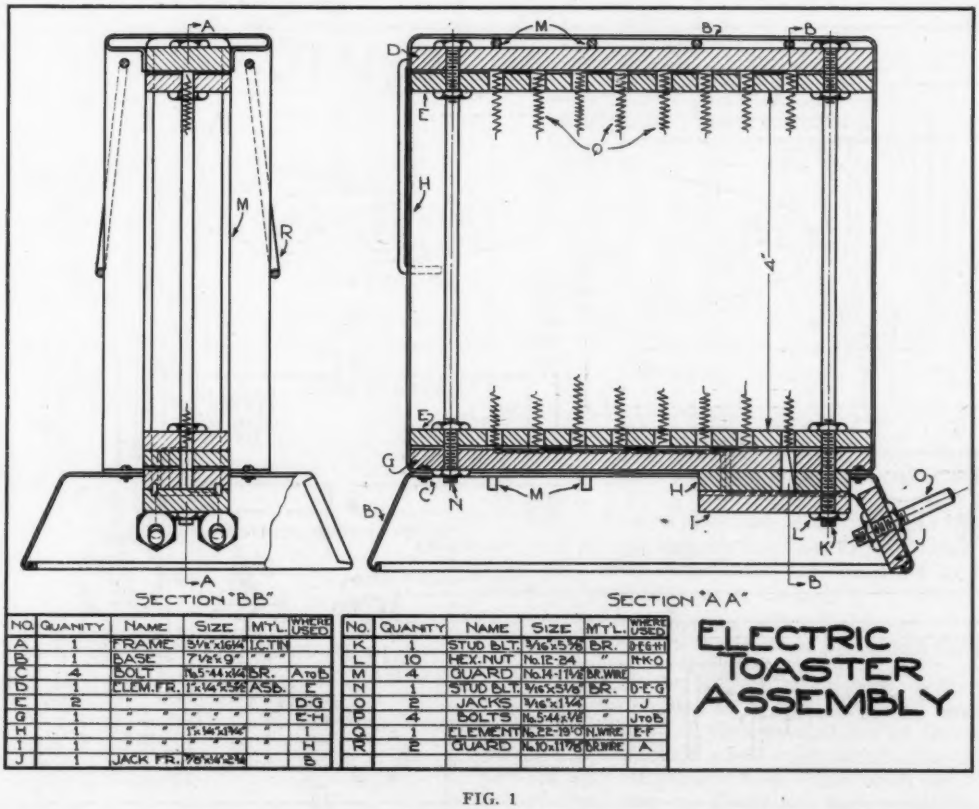
ELECTRIC TOASTER

Allan V. Winegard, Glenside-Weldon Junior High School, Roslyn, Pennsylvania

The electric toaster described in this article has been found to be an interesting as well as an instructive project in the general shop of the Glenside-Weldon Junior High School. The project involves experiences in sheet-metal work, electrical work, and some machine-shop work.

The operations should be performed in the following order:

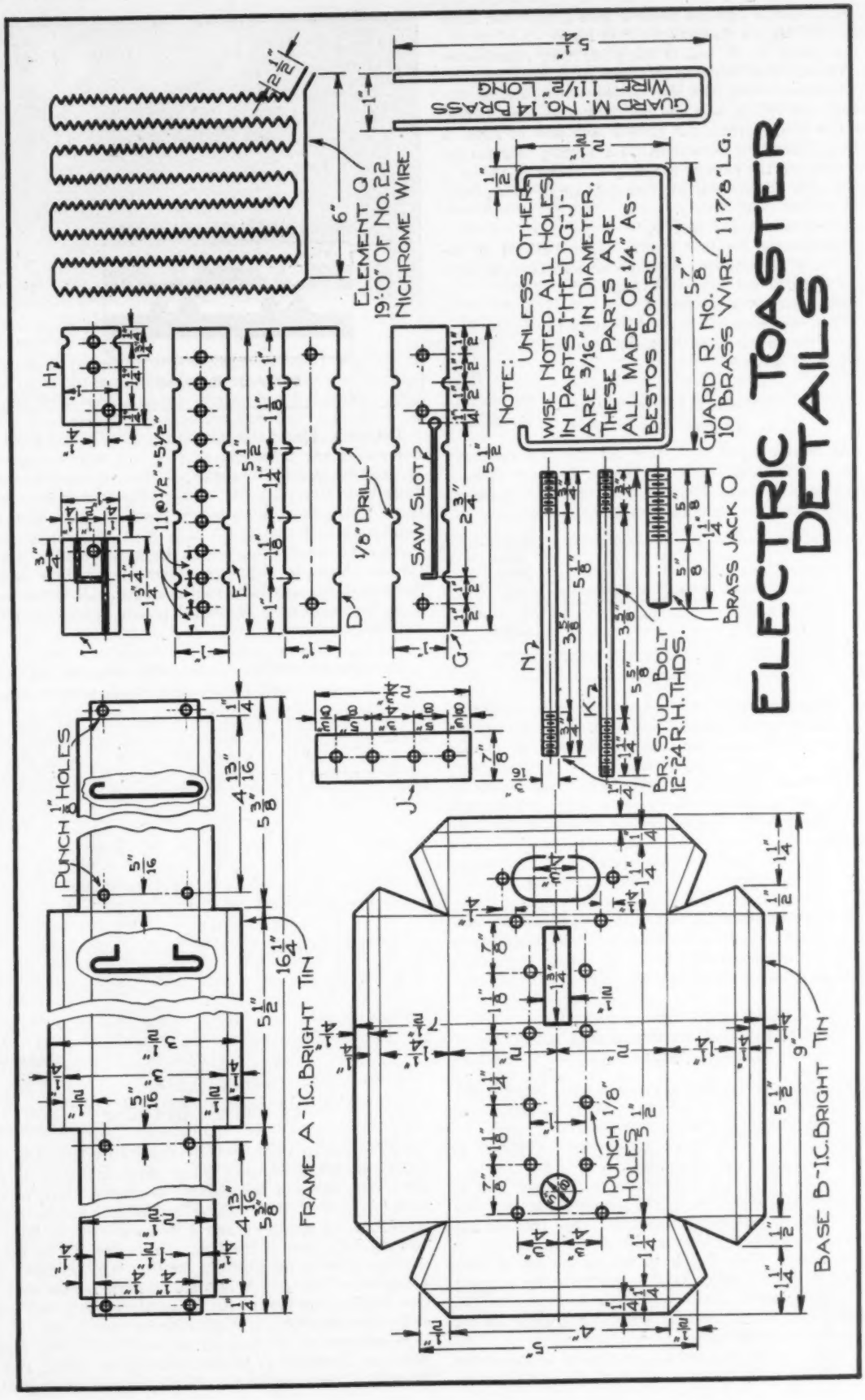
1. Lay out and cut out of ¼-in. sheet asbestos, pieces D,



NO.	QUANITY	NAME	SIZE	M'T'L.	WHERE USED
A	1	FRAME	5⅛"x16¼"	I.C.TIN	
B	1	BASE	7½"x9"	" "	
C	4	BOLT	No.5-44x1½"	BR.	A to B
D	1	ELEM. FR.	1"x14"x.5/8"	ASB.	E
E	2	" "	" " "	"	D-G
G	1	" "	" " "	"	E-H
H	1	" "	1"x14"x1/16"	"	I
I	1	" "	" " "	"	H
J	1	JACK FR.	7/8"x4"x2¼"	"	B

No.	QUANITY	NAME	SIZE	M'T'L.	WHERE USED
K	1	STUD BLT.	3/16"x5 5/8"	BR.	D-E-G-H
L	10	HEX. NUT	No.12-24	"	M-N-O
M	4	GUARD	No.14-1 1/4"	BR. WIRE	
N	1	STUD BLT.	3/16"x5 1/8"	BR.	D-E-G
O	2	JACKS	3/16"x1 1/4"	"	J
P	4	BOLTS	No.5-44x1/2"	"	J to B
Q	1	ELEMENT	No.22-19'0"	N.WIRE	E-F
R	2	GUARD	No.10x11 7/8"	GR.WIRE	A

FIG. 1


ELECTRIC TOASTER DETAILS
ELEMENT Q 19'-0" OF No. 22 NICHROME WIRE
GUARD M. No. 14 BRASS WIRE 11½" LONG
NOTE: UNLESS OTHERWISE NOTED ALL HOLES IN PARTS H-E-D-G-J- ARE 3/16" IN DIAMETER. THESE PARTS ARE ALL MADE OF 1/4" ASBESTOS BOARD.
GUARD R. No. 10 BRASS WIRE 11 7/8" LG.
BRASS JACK O
BR. STUD BOLT 12-24 R.H. THDS.
SAW SLOT 2
1/8" DRILL
PUNCH 1" HOLES
FRAME A - 1 C. BRIGHT TIN
PUNCH 1/8" HOLES
BASE B - 1 C. BRIGHT TIN

E, G, H, I, and J. This can be done with a hack saw. Drill all holes and saw all slots called for in Figure 2.

2. Cut pieces K, N, and O out of 3/16-in. round brass stock. Thread them as shown in Figure 2 with a 12–24 die.

3. Wind the element on a piece of No. 10 wire leaving two free ends, one 2½ in. long and the other 6 in. long. Divide the coil in 8 equal parts and stretch each part to make it 4 in. long. Thread the element on the asbestos pieces marked E and complete the element assembly as shown in Figure 1 in section AA. Be sure that the free ends are in their proper slots to prevent short circuits.

4. Make frame A and base B.

5. After placing the four guards, M, in position in the slots of the asbestos pieces, place the element assembly into frame A and bolt the latter to base B.

6. Fasten piece J to the base B.

7. Attach the element wires to the jacks O.

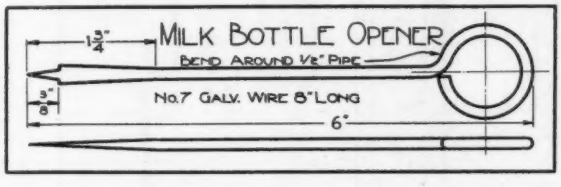
8. Place the guards R in the holes on frame A.

9. Finish as desired.

MILK-BOTTLE OPENER

J. T. Hayes, Bucyrus, Ohio

In the general metal shop there are always a few boys who finish their work before the others. In order to have a smooth-running shop these boys must be kept busy at all times, otherwise they are apt to get into trouble.



It is necessary, therefore, to have a number of supplementary jobs or projects that can be used. The projects must have value the same as the core projects and in no case should they be simply "busywork."

The milk-bottle opener is a project which can readily be made by a boy in the seventh or eighth grade, yet it is not so easy as to cause him to feel that he is making something too simple.

Method of Procedure

1. Cut wire to length.
2. File one end square.
3. Bend this end around ½-in. pipe, using hammer and vise.
4. Flatten the end as shown, using anvil and hammer — do not leave any hammer marks.
5. File as shown in the drawing.

NOVELTY BREAD BOARD

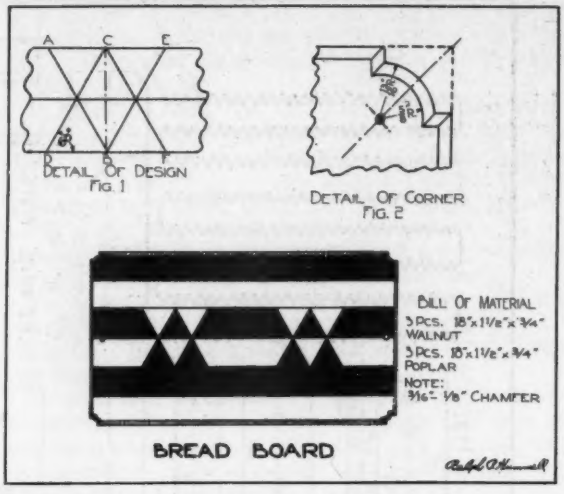
Ralph P. Hummell, Washington High School, Washington, Pennsylvania

The accompanying illustration shows a novel bread board. It is made of three strips of walnut or any other dark, close-grained wood, and three strips of white poplar or maple.

In making this board great care must be exercised in getting the six strips the exact width.

After having finished the six strips to the exact size as to width, the next step is to lay out the design, as shown in Figure 1. This is done by clamping two strips together and then laying out the lines shown with a 60-deg. triangle or with a protractor. Then the blocks are cut out on the lines AB, CD, EB, and CF with a hand or band saw. By reversing these blocks as shown, a rather pleasing design is obtained. The writer finds that if carefully sawed, these blocks do not need planing before gluing.

The design can be repeated as many times as the maker wishes.



The design blocks and the outside strips are all glued and clamped at one time.

After the glue is thoroughly dry the next step is planing down both faces to a flat surface. The thicker the original stock is the better, since by this means a better glue joint can be obtained.

After the board is squared up, the corners are laid out and cut, as shown in Figure 2. These corners also may be designed to suit individual tastes. A ⅜-in. hole is then bored 1 in. from each end. The board is then sanded thoroughly and shellacked.

BRONZE-WELDING A CRACKED ENGINE BLOCK

R. F. Jennings, South High School, Minneapolis, Minnesota

The last quarter century has witnessed an ever-increasing use of the oxyacetylene welding and cutting processes. These processes are used so universally and in so many branches of industry that year by year the demand for trained welders is increasing.

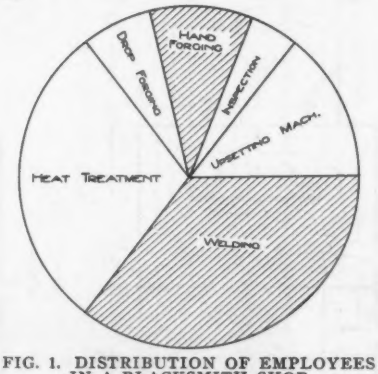


FIG. 1. DISTRIBUTION OF EMPLOYEES IN A BLACKSMITH SHOP

The extent to which welding and cutting are used in a typical modern industrial plant is shown in Figure 1. This shows the number of men engaged in welding compared with other activities of the "blacksmith shop" of a middle western tractor factory employing over a thousand workers. As in the "old days" this part of the plant is still called the blacksmith shop but new developments in the field have brought about a number of changes. A separate building is now used for heat treating, and the number of welders exceeds the number of blacksmiths employed at hand forging four to one.

As indicated by the diagram the employees in this department are distributed as follows: gas welding, cutting and arc welding, 38 per cent; heat treatment, 30 per cent; upsetting

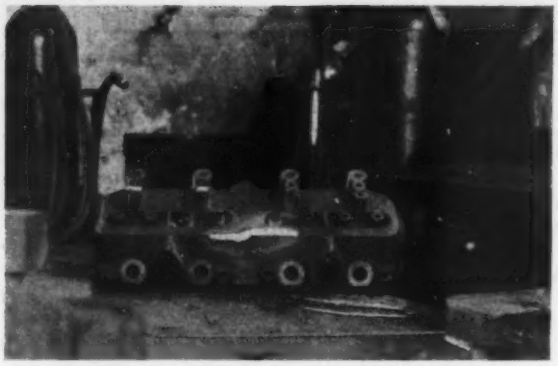


FIG. 2. BRONZE WELDING WITHOUT PRE-HEATING

machines, 13 per cent; hand forging, 9 per cent; drop forging, 5 per cent; and inspection, 5 per cent. Twenty-five years ago there were no welders in this department. Today the welders outnumber any other group in the shop. Let us consider just one of the many kinds of work done with the welding torch that has contributed to its high utility.

One of the more recent applications of oxyacetylene welding is bronze-welding cast iron. This process is also called "brazing," but due to the fact that the same apparatus is used as in fusion-welding it is more popularly known as "bronze-welding." The remainder of this article will be devoted to a typical job in bronze-welding, namely, repairing a cracked water jacket on an automobile engine without preheating.

When these cracks occur in places similar to that shown in Figure 2 they can be bronze-welded without preheating and in some cases without dismantling the engine more than enough to make the weld accessible. However, when bronze-welding is done on an assembled engine extreme care must be exercised not to burn or overheat parts adjacent to the weld. These should be protected by covering with wet asbestos or with a dry asbestos sheet.

The first step after dismantling is to "vee" out the crack. This should be done with a cold chisel, cutting about three fourths of the way through the wall of the water jacket or at least to a depth of 3/16 in. The angle between the sides of the "vee" should be approximately 90 deg. A portable grinder should not be used for this purpose, for a rough chiseled surface is preferable to a ground or a machined surface. It is important to have the place to be welded and the adjacent area clean and free from grease.

The proper quality of bronze filler rod as well as a suitable size will be found essential to good results. Tobin bronze melts at about 1,625 deg. F., and in the 3/16-in. size gives excellent results.

The secret of making a successful weld depends upon two things, first, successful "tinning," and second, making the weld with a minimum of heat.

Tinning the Surface

"Tinning" here refers to thoroughly coating the surface to be bronze-welded with a flow of bronze from the filler rod. This is done at the same time as the rest of the welding and concerns the application of the first bronze that is brought in contact with the "vee." When properly "tinned" the bronze adheres to the cast iron with great strength making a weld that is much stronger than the cast iron itself. Good "tinning" depends upon four things. First, the "vee" must be clean and somewhat rough. Second, the spot that is to be "tinned" must be heated to a cherry-red heat. Third, a generous amount of a good grade of bronze-welding flux should be applied both to the "vee" and to the heated end of the bronze filler rod. And fourth, the bronze filler rod must not be overheated. It is easy to burn the strength out of the filler rod by overheating the bronze. The bronze should look "wet" during the tinning and subsequent building-up process. The bronze should be flowed on and let alone. Just enough heat should be applied to run the bronze on smoothly.

The second requirement of a successful job, namely, making the weld with a minimum of heat, applies to the total heat applied to the casting and the way in which it is applied. Unless the heat is applied in the proper manner the casting is almost sure to crack when it cools. Starting at one end of the crack the "vee" can be heated to a cherry red and bronze-welded for an inch or so. Then the opposite end of the break can be welded for a like distance. After the weld has been started from each end a short section can now be welded in the center of the break, after which the remaining space can be welded in short heats, working first on one side of the center and than on the other. When possible, it is well to have the "vee" in a slightly slanting position and work "uphill" so the bronze will tend to run away from the newly "tinned" area on to the finished side.

A bronze-weld of the type shown in Figure 2 is a permanent repair. If it is desired, the ripples can be filed off with a coarse file or smoothed with a portable grinder and painted, making the repair invisible.

BRAZING THE BAND SAW

C. W. Illingworth, Racine, Wisconsin

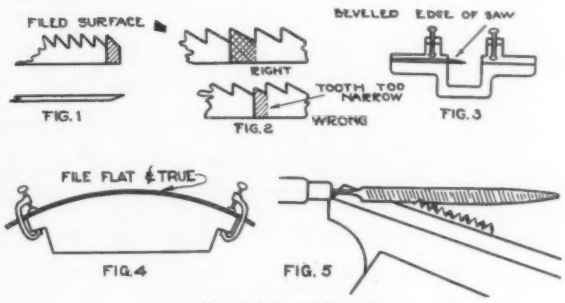
Broken band-saw blades may be joined together by brazing, which is a form of welding. There are numerous methods of doing this, but the system of using tongs, clamp, and a blowtorch will be treated here.

Square the ends of the saw carefully and holding one end in the clamp, file a bevel about the width of one tooth (see Fig. 1). Then file the other end in the same manner. One end should be filed on the upper side and the other on the underside. The bevels must be flat, true, and to a knife edge. The success of a brazing job depends largely on the care that is taken to file and fit the two bevels together. When they are fitted one tooth will be made up of the two beveled sections of the saw, hence it will be properly spaced so that its point will be the correct distance from the next tooth (see Fig. 2).

Now clamp one end in the vise with the back edge of the saw against the guide and the beveled edge up and about in the middle of the opening, Figure 3. Then clamp the other end in place in the same manner, but so that the top lap covers and fits the lower lap perfectly, with the points of the teeth spaced properly.

When the ends are secured in position, raise the top end and clean the laps with diluted muriatic acid. Wipe dry with a clean cloth. Cut a strip of silver solder a trifle larger than the lapped surface and clean it in the same manner as the laps. Sprinkle on the solder and on the laps a little dry borax or borax paste and slip the solder in place between the laps.

Have the tongs handy, and with the blowtorch turn on so that there is a hot, blue flame, turn the flame on the joint. A shield of sheet metal should be placed back of the clamp so as to deflect the flame. It is well to heat the jaws of the tong before applying them, otherwise they might chill the braze.



BAND-SAW BRAZING

Hold the flame on the joint just long enough for the solder to melt thoroughly and for the saw to turn a bright red. At this point quickly and carefully clamp the tongs over the joint and hold for about ½ minute or until you are sure the solder has set.

Remove the clamp and clamp the brazed section on a curved block to file and emery the flat surface true and free from lumps. Reverse and do the other side (see Fig. 4).

The saw should then be put in the saw-filing vise and any lumps filed out with a three-cornered file (see Fig. 5).

Next, cover the brazed part with a heavy oil and heat carefully with the blowtorch until the bright parts turn a straw color. This will stiffen the braze and prevent bending while the saw is being handled.

WOOD LATHE CENTERS

G. H. Snaddon, Central High School, Detroit, Michigan

Processes Involved: Cylindrical turning between centers; taper turning; angle cutting; use of dividing head.

Problem: To make spur and cone centers for wood-turning lathes.

Specifications: Use C. R. or T. S. ¼-in. oversize.

Procedure: 1. Select stock; add at least ¼ in. to the finished length shown in the blue print; mark to length; saw to the mark in the power hack saw.

Explanation: Additional length is to allow for removing the center hole on one end.

2. Remove the faceplate from the lathe spindle, clean the threads in the lathe chuck and the threads on the lathe spindle; oil the lathe-spindle threads.

3. Mount the three-jaw universal chuck on the lathe.

4. Chuck the stock; face one end and center; remove stock from the chuck; mark to length; face to the mark; center.

5. Remove the chuck; mount the face plate.

Caution: In removing the chuck from the lathe, place a piece of board across the carriage to prevent the chuck from dropping on the lathe bed or on your fingers.

6. Calculate the tailstock set over or set the taper attachment. (Refer to the chapter assigned under References on the cutting tapers and angles.)

7. Set the tool bit on the center line of the lathe; test by placing against the headstock or tailstock center.

8. Lubricate the dead center; mount the stock between centers.

NOTE: Be sure the dog tail does not bind nor bottom in the slot of the faceplate.

9. Rough-turn the taper, use medium speed and coarse feed.

10. Resharpen and oilstone the tool bit, then take a light trial finishing cut.

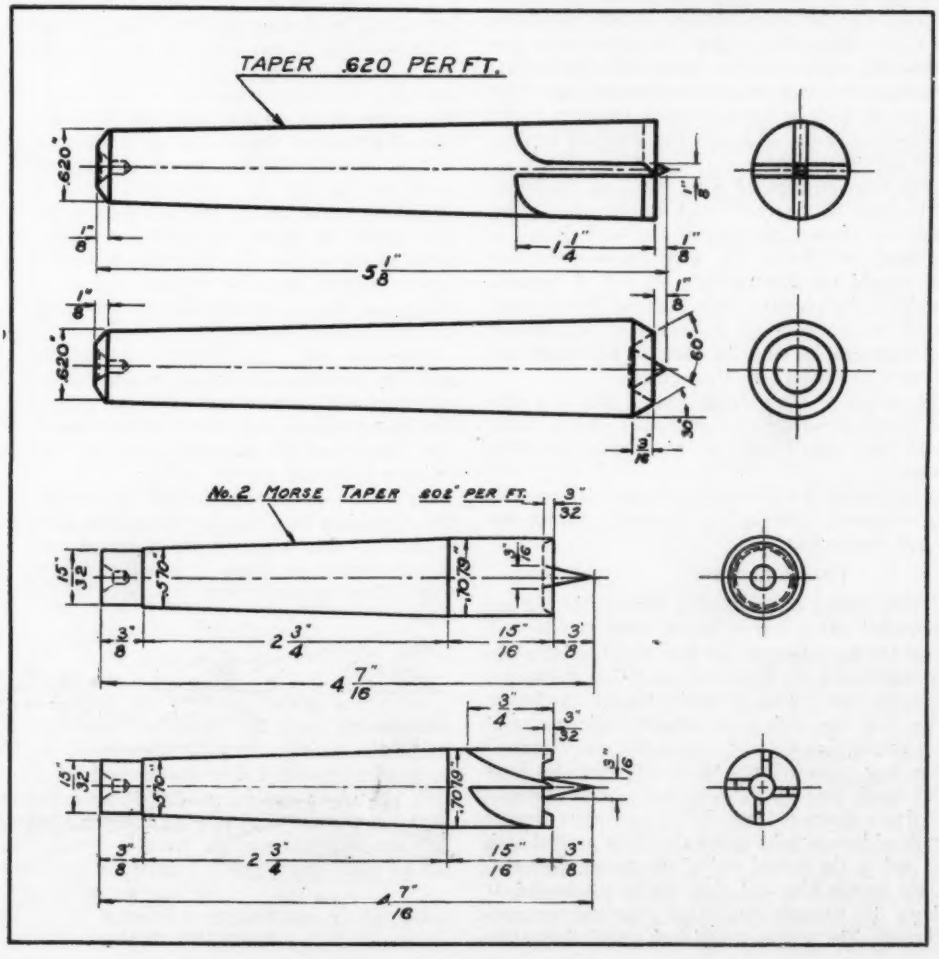
NOTE: The taper should be oversize at this stage. The testing must be done before the taper is too near the finished size so as to allow for corrections.

11. Clean the work and the gauge carefully:

a) Draw three chalk lines approximately equidistant along the entire length of the taper.

b) Test the taper in the gauge with a rotating counter-clockwise movement.

c) If correct, the taper should show even contact throughout its whole length.



d) Provided it does not, adjust the tailstock or taper attachment slightly and take another light trial finishing cut.

e) Continue by this cut-and-try method until the taper is correct. Use a light application of Prussian blue on the surface instead of chalk to test the final accuracy.

12. File lightly with a smooth file to remove the tool marks; polish with emery cloth.

NOTE: Use a faster speed for polishing than for filing. Leave a few thousandths only for filing; always avoid excessive filing. When polishing, place the emery cloth on a stick, press hard against the revolving stock and move the emery cloth back and forth over the surface. Use oil on the work and the emery cloth.

13. To finish the point, fit the center into a taper sleeve, then fit the sleeve into the headstock spindle of the lathe.

14. For cone center:

a) True the center and face until the center hole is removed or to the required length.

b) Cut the point and the other angles by using the compound.

c) Finish with a smooth file and emery cloth.

For spur center:

a) Face to required length; cut the point by setting the compound.

15. Milling spur center:

a) Fit the center to a sleeve, then fit the sleeve to the milling-machine dividing head.

b) Set the milling cutter the correct distance off center.

c) Rough-mill all around; use ten turns on any circle; use medium speed and feed.

d) Raise the table the correct amount and finish-mill all around.

e) Remove from dividing-head spindle and sleeve.

f) Place in a vise and file the four edges to a point.

General Notes: 1. It is extremely important that the threads in the lathe chuck be kept clean and free from chips and dirt at all times. The lathe chuck threads and lathe spindle threads should be cleaned carefully before mounting the chuck.

2. The work and the gauge, or the lathe spindle (if that is being used as the gauge) must be cleaned thoroughly before the center is fitted in place.

3. If the lathe chuck cannot be easily removed by ordinary means, use a lead hammer or a block of wood and a hammer to loosen it.

Appraisal: Both centers should fit the gauge or the lathe spindle and tailstock accurately; they should be smoothly finished; the points or ends on each should be correctly milled and shaped. Submit the finished centers to your instructor and get his approval of them.

Tools Used: Ruler; scratch awl or scriber; power hack saw; three-jaw universal lathe chuck; center drill; safety lathe dog; calipers, micrometers; tool bit; sleeve; milling cutter; dividing head.

Application or Use: Wood lathe centers are used to support and drive wood while it is being turned to shape in the lathe.

References: Smith, *Advanced Machine Work*, section 2, pages 26 to 31; Burghardt, *Machine Tool Operation*, Chapter IX.

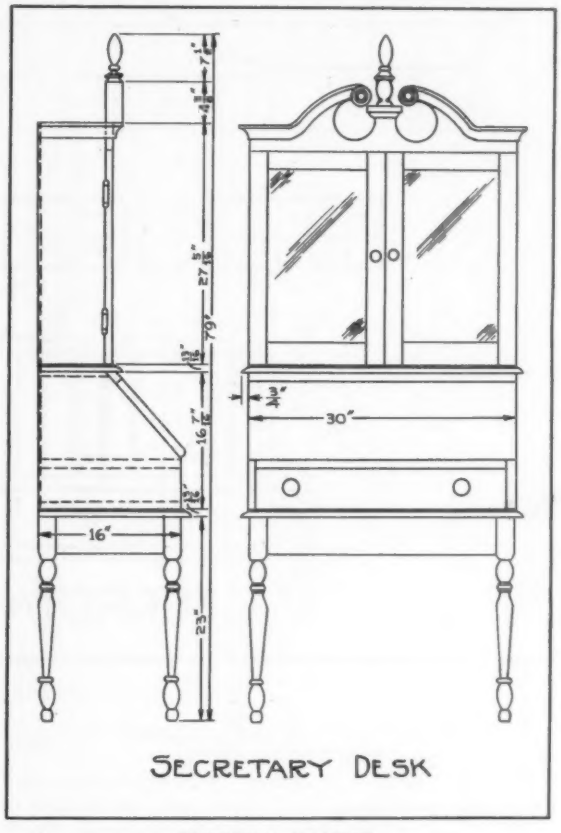
Questions

1. Show why the lathe-dog tail should not bind or bottom in the faceplate slot.
2. Describe how to test a taper in a gauge.
3. What are clockwise and counterclockwise movements?
4. What is meant by the cut-and-try method?
5. Why is Prussian blue used in preference to chalk in testing for final accuracy?
6. Tell how to polish a piece of work in the lathe.
7. Show why ten turns on any circle are used on the milling-machine dividing head to secure four equal divisions.

COLONIAL SECRETARY DESK

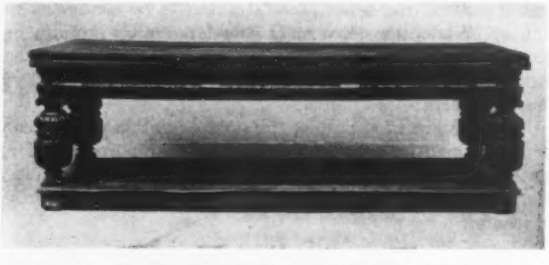
Leslie H. Murphy, Princeton, Kansas

The Colonial secretary described herewith is made in three parts: the base, the desk, and the bookcase. They are fastened together with screws so they can be taken apart for shipping. In the final assembly, it is put together with glue. Mortise and tenon joints are used on the base, and blind rabbet joints are used on the desk and bookcase.

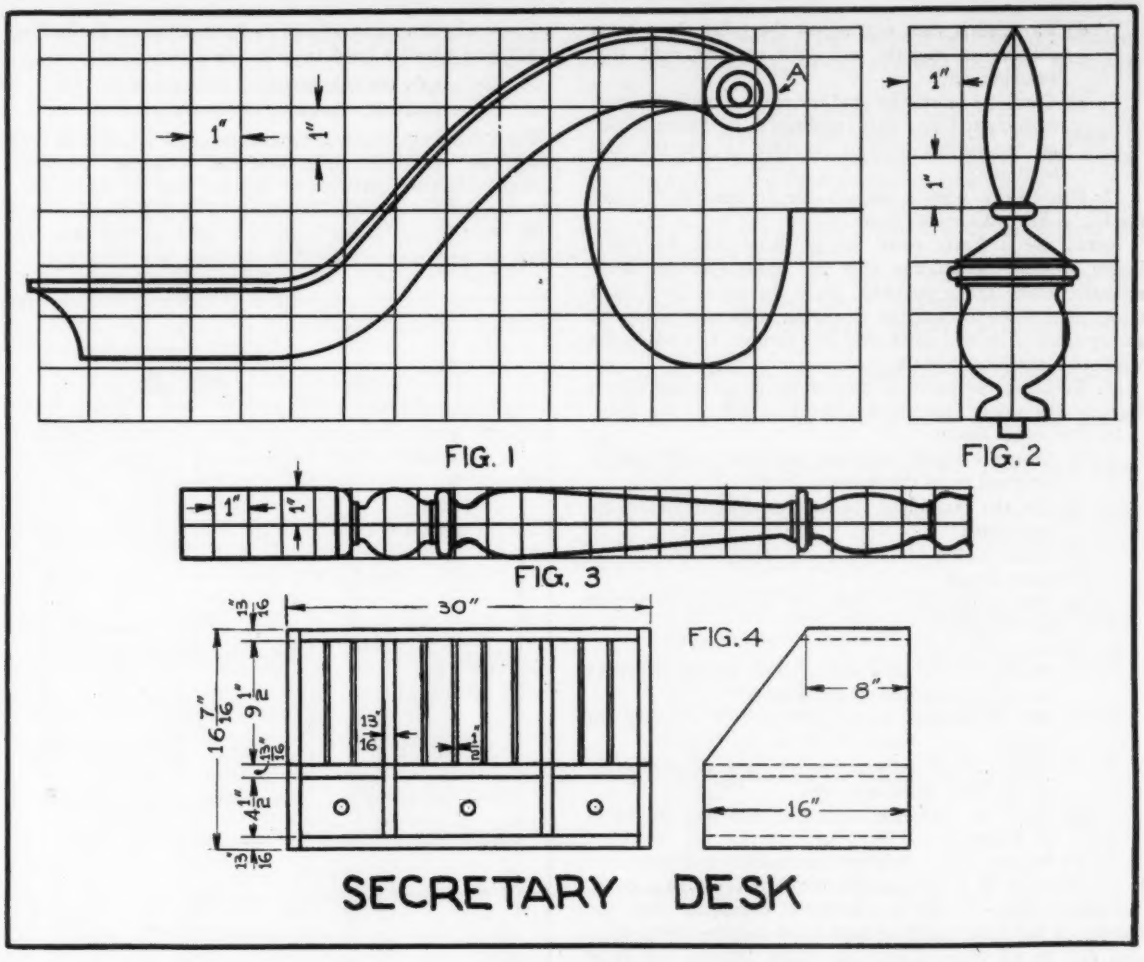


ASSEMBLY OF DESK

In constructing the top of the bookcase, first lay off the pattern on a 1-in. board, as shown in Figure 1. Next, make a template for the molding. This should be done on a 1½-in. board. It is best if the entire molding for the front is all laid out on one board. On the band saw, cut to the mark and then shape on the shaper. Next, glue the molding on. Then turn the flaming torch, Figure 2 and A in Figure 1. The layout for the legs is shown in Figure 3. Figure 4 shows the pigeonhole construction.



DRAW TABLE WITH BULBOUS TURNED LEGS AND HEAVY STRETCHERS
Metropolitan Museum of Art, New York City



DETAILS OF DESK

MASSACHUSETTS OFFERS COURSES FOR THE UNEMPLOYED

The state education department of Massachusetts, under the personal direction of Dr. Payson Smith, commissioner of education, has recently evolved a novel idea for the benefit of idle workers, through which both hope and occupation will be provided for those worried over the search for jobs.

Since the first part of December, vocational-guidance experts of the state department have conducted conferences at the Burroughs Foundation for unemployed workers, and for those who fear they may have to make a readjustment in their jobs. At the conferences the experts endeavored to discover the general lines of work for which the workers are best qualified, and what opportunities were available in educational institutions for obtaining fundamental knowledge of the lines selected. The conferences were preliminary to classes for the unemployed which were arranged to be conducted in January. While the department could not give promise of securing jobs for the graduates, still it was believed that the work undertaken would offer definite value to the persons who took them.

Under the law of the state, the state education department charges a small fee for such courses. It is the purpose of Dr. Smith to obtain permission from the legislature for holding free courses for persons who are unemployed during the present winter.

MOP TRUCK

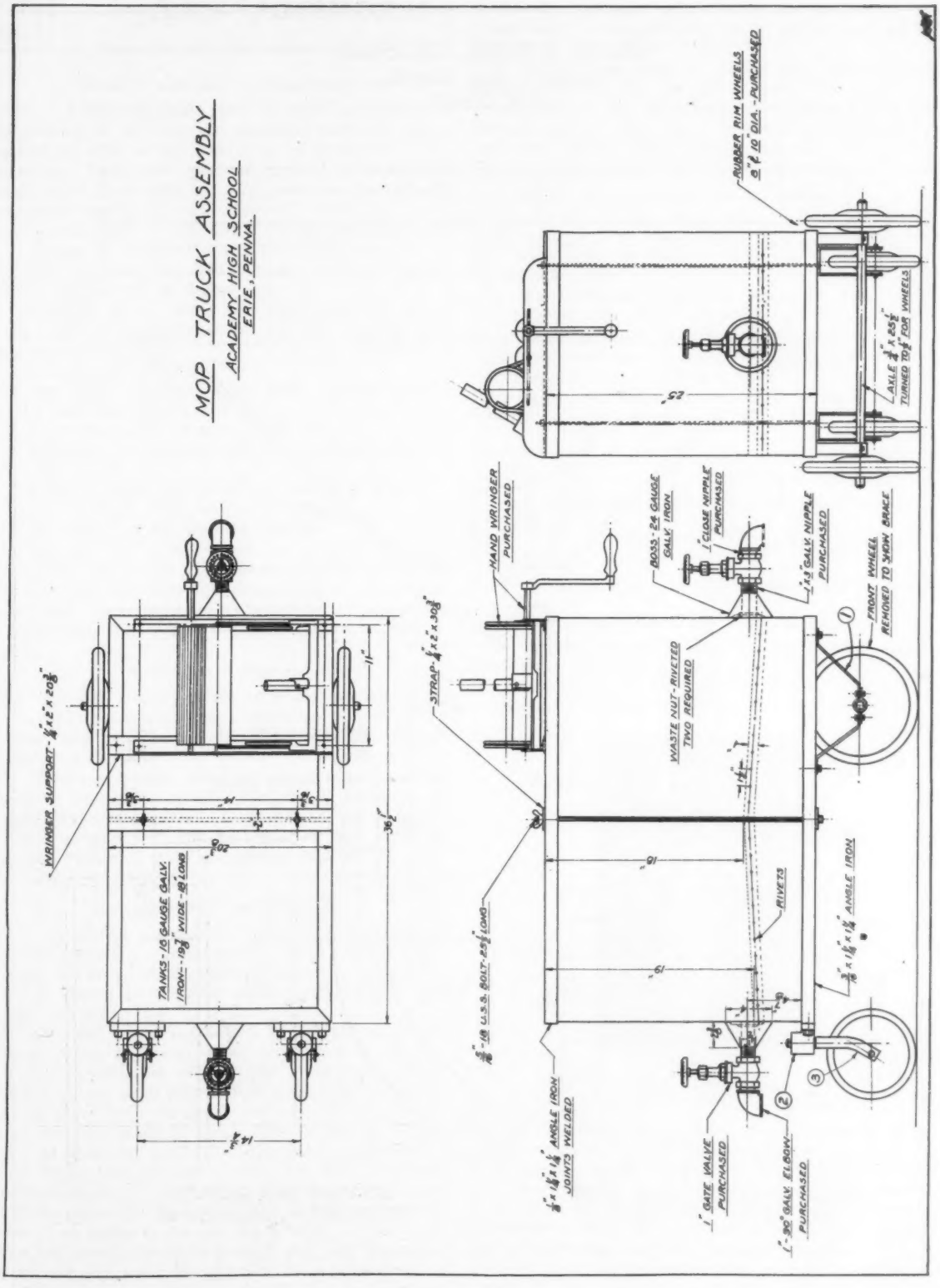
Harry E. Andersen, Erie, Pennsylvania

The mop truck shown in the accompanying illustrations is the result of several years' development. Trucks made from these drawings are used in the school buildings of Erie. They are found to be labor-saving; of sturdy construction, and convenient. School engineers and sheet-metal-shop instructors

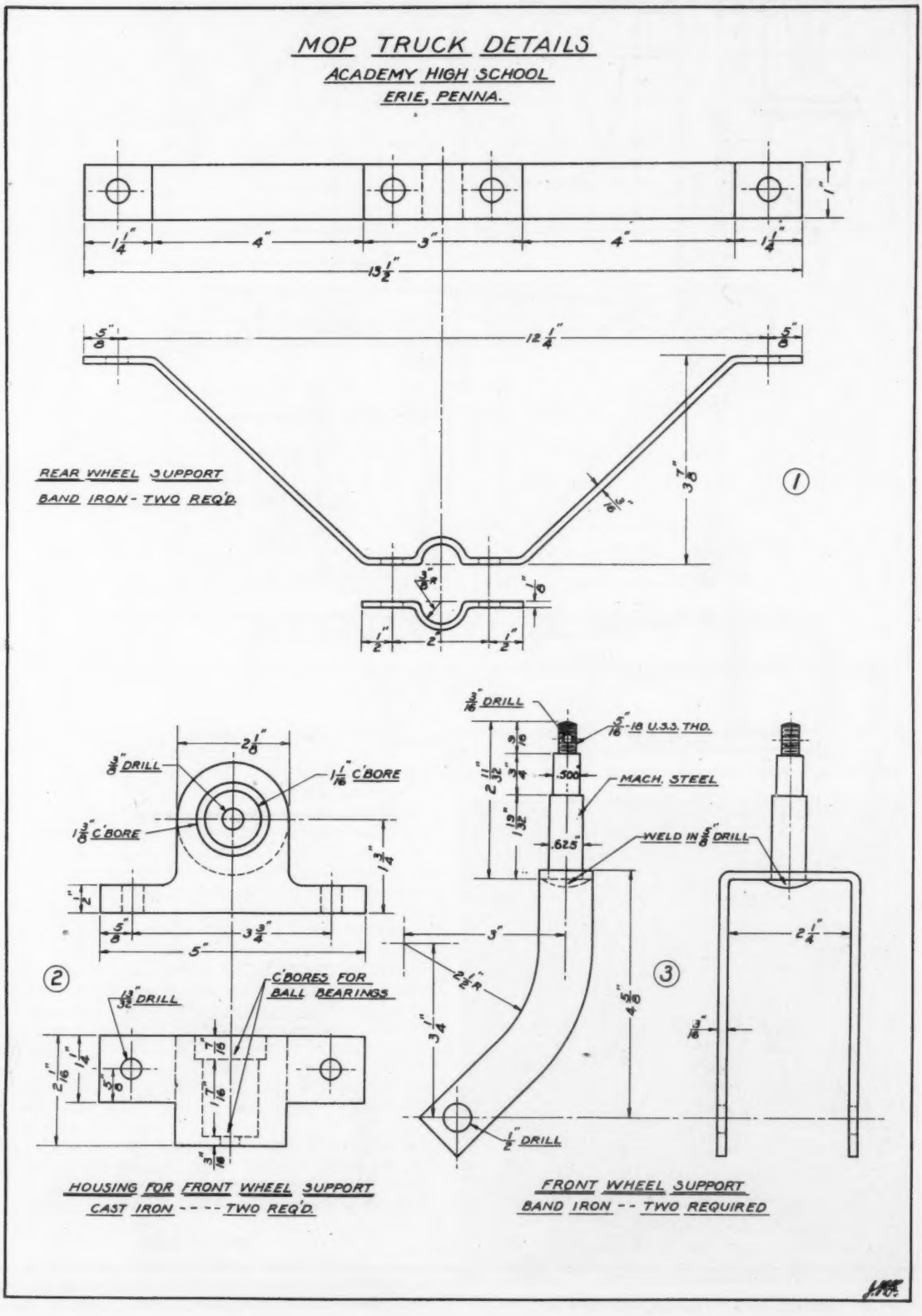
THE MOP TRUCK READY FOR ACTION

might find this an interesting project.

The construction requires several purchased items which are noted in the assembly drawing, a framework, tie straps, a cast-iron housing, front-axle and rear-wheel supports, a rear axle and two sheet-metal tanks. The faucet boss on the tanks is developed by the simple radial-line method. The


MOP TRUCK ASSEMBLY
ACADEMY HIGH SCHOOL
ERIE, PENNA.
RUBBER RIM WHEELS
8" OR 10" DIA. - PURCHASED
AXLE 1" X 25½" TURNED TO ½" FOR WHEELS
HAND WRINGER PURCHASED
BOSS - 24 GAUGE GALV. IRON
1" CLOSE NIPPLE PURCHASED
1" GALV. NIPPLE PURCHASED
FRONT WHEEL REMOVED TO SHOW BRACE
STRAP - ¼" X 2" X 30½"
WASTE NUT - RIVETED TWO REQUIRED
RIVETS
¾" X 1½" X 1½" ANGLE IRON
⅜" - 16 U.S.S. BOLT - 2½" LONG
¾" X 1½" X 1½" ANGLE IRON JOINTS WELDED
1" GATE VALVE PURCHASED
1" - 90° GALV. ELBOW PURCHASED
WRINGER SUPPORT - ¼" X 2" X 20½"
TANKS - 16 GAUGE GALV. IRON - 19½" WIDE - 28" LONG
11"
36½"
14½"
23"
91"
51"

pattern for the housing can be made in a school pattern shop and the housing and axle can be machined in the school machine shop. When the tanks are no longer serviceable, they can be taken off the framework by removing the wing nuts. New tanks can then be made to replace the worn ones and the mop truck is completely rehabilitated.



NOW, Are There Any Questions?

Finishing a Walnut Veneered Table

934. Q.: Will you please send me some information on how to finish an end table top, mahogany inlay and walnut veneered on white wood? This is to be finished to match walnut legs. What water stain and method? What oil stain and method? How to mix and what powder to use? Process to be either varnish or lacquer finish.—*T. F. P.*

A.: Specifications for Finishing a Walnut Veneered Table:

1. Sponge the entire job with a clean moist rag.
2. Dry and sand with a split 6/0 paper. Test for blistered spots by tapping with the fingers.
3. Dust off, apply a warm stain made from four ounces of any standard water-stain powder. Let solution stand overnight, pour off top.
4. Let stain dry overnight.
5. Size entire job with orange shellac reduced with 4 parts of denatured alcohol. Dry hard.
6. Sand with a split 6/0 paper. Dust off.
7. Fill with a dark-brown chocolate silex filler. Clean off well. Dry 48 hours.
8. Apply a coat of well-brushed-out four-hour varnish.
9. Dry overnight. Sand with old 6/0 paper.
10. Revarnish, dry, and resand as desired.
11. Rub last coat with FFF pumice, crude oil, and felt. Give a final cleanup with a handful of cotton waste wet well with water and used to rub the sludge from the oil rubbing. Do all final strokes along the main axis of the top. Clean up with clean, soft rags in the same manner.—*Ralph G. Waring.*

A Question of Sprayers

935. Q.: Can ordinary shellac as bought in quart bottles be sprayed on projects by using a small hand sprayer similar to those used for insect sprayers? Can lacquer be thus sprayed?—*T. F. P.*

A.: Shellac or lacquer cannot be successfully sprayed by other than adequate machinery designed for this work. In general, an efficient machine requires 7 cu. ft. per minute at 50 pounds pressure to do this work in production. For other types and quality of work, less efficient machines are available.—*Ralph G. Waring.*

Retouching Dents and Scratches

936. Q.: Would you give me information on retouching dents and scratches (1) in the end of a piano received during moving; (2) walnut-veneer table top scratched, so that the veneer is pierced at one place, while at other places it is merely scratched?—*T. F. P.*

A.: The deep scratches will need a touch of water stain. Let dry. Secure a stick of shellac for burning in scratches of a color to match the work in hand. Warm an old table knife over a very small flame free of smoke until the shellac will melt gently when touched by the blade. Use this warm, but not hot, knife to rub the shellac carefully into the scratch, until a bit more than level full. Use a razor-edged chisel to cut the shellac level with the varnish. Rub down to a finish with crude oil and FFF pumice stone, then clean up the entire end of the piano with the cotton-waste method mentioned in section 11 of answer to question No. 934.

The light scratch should be brushed with pure turpentine. Let dry and then use a No. 2 red sable lettering brush to run in a pin stripe of four-hour varnish. Let dry hard and sand lightly with old 6/0 paper. Avoid getting the varnish outside of the scratch as much as possible. Repeat until the scratch is more than leveled with the dried varnish, then rub as mentioned in the foregoing.—*Ralph G. Waring.*

Staining Plastic Wood

937. Q.: Can you secure for me the method to stain plastic wood? I have had boys use the plastic wood and had difficulty staining same.—*T. F. P.*

A.: Plastic wood must be colored with pigment colors quite a bit darker than the stained wood. If the material is too dry, then it may be reduced to the proper glazing condition by adding a few drops of brushing lacquer and working well with a flexible putty knife. Plastic wood will not take stain of any kind after it has once dried.—*Ralph G. Waring.*

Cabinetmakers' Guild Emblem

938. Q.: We desire a copy of the emblem used by the Cabinetmaker's Guild, and would like to know if you can point out a source to which we may go to secure a copy of this emblem.—*Inq.*

A.: The above information may be secured from the following book: *The Book of Public Arms—A Complete Encyclopedia of all Royal, Territorial, Municipal, Corporate, Official and Impersonal Arms,* by Arthur Charles Fox Davies. This was published in 1915 in London by T. C. and E. C. Jack, 35 Paternoster Row, London, E.C. 4, England.—*H. C. Moor.*

Among the Industrial-Arts Teachers

THE NEW DIRECTOR AT WASHINGTON

Mr. Zearfoss, who was recently elected director of manual training at Washington, D. C., is a graduate of the Williamson Trades School, and has completed work at Columbia University and at George Washington University, Washington.

J. ELMER ZEARFOSS
Director of Manual Training,
Washington, D. C.

He was an instructor in the vocational department at Philadelphia and Erie, Pa., and a director of manual arts in the State Normal School, Geneseo, N. Y. Previous to taking his present position, he was head of the shop department in the McKinley High School, Washington, D. C. He is a contributor to the educational periodicals on subjects pertaining to industrial arts and vocational education.

¶ Mr. L. W. George has been appointed as instructor in manual training at Cedar Rapids, Iowa.

¶ Mr. E. E. Hobbs, of Noblesville, Ind., has taken a position as instructor in the high school at LaPorte, Ind.

¶ Miss Mary J. Drucker, has been appointed vocational counselor on the staff of the vocation bureau of the Cincinnati public schools.

¶ Mr. R. M. Sensenbrenner and Mr. L. W. Whitemore have been appointed to the vocational board at Menasha, Wis.

¶ Mr. F. W. Paul has been appointed president of the vocational board at Eau Claire, Wis. Mr. F. W. Paul was reëlected as secretary.

¶ Mr. Cacleton Saecker and Mr. F. E. Bachman have been reëlected to the vocational board at Appleton, Wis.

¶ Mr. A. A. Dodd, principal of the Manual Training High School, Kansas City, Mo., died at his home in that city, January 23, after nearly a year of ill health.

Mr. Dodd, who was 74, was born in Ohio. He began teaching at the age of 15, shortly before the completion of his college course. In 1886 he received his Master's Degree at the Warrensburg, Mo., Normal School, and later he entered Harvard University, graduating in 1895. In 1896 he became principal of the Scarritt School, resigning in 1897 to become a member of the faculty of the Manual Training High School. He became principal of the school in 1921.

¶ The title of Mr. Dean M. Schweickhard, director of vocational education of Minneapolis, Minn., has been changed to assistant superintendent in charge of vocational education, attendance, placement, and guidance.

¶ Mr. Harold S. Falk, vice-president and works manager of the Falk Corporation, Milwaukee, was recently appointed a member of the Wisconsin State Board of Education. Mr. Falk succeeds E. J. Kearney, Milwaukee, who resigned. He is a member of the Milwaukee board of vocational education, and is co-author of a series of lessons used by plants in factory foremanship schools.

¶ Prof. Michael Dreese, head of the vocational-guidance department of Grinnell College, has been reëlected president of the Iowa Vocational Guidance Association. Professor Dreese presided at the annual meeting of the association in Des Moines.

New Publications

Circles and Squares

By Marguerite Marquart and Jean T. Mitchell. Paper, 78 pages, 7½ by 11, illustrated. Published by World Book Company, Yonkers-on-Hudson, New York.

The author has succeeded in presenting a lot of interesting problems for the youngster who is making his first journey into the field of sketching. Without going into technical language, the material explains and illustrates very clearly just how to handle the circle and the square in sketching.

The Ways of the Sea

By Charles G. Davis. Cloth, 185 pages, 6½ by 9½, illustrated. Price, $4. Published by The Rudder Publishing Company, New York City.

This delightful book, while not giving the teacher who wants to design boats, ships and models, any direct information, will furnish several hours of delightful reading about ships that have made history. The chapters of the book were originally published in *The Rudder*, and they have been put into book form because of the interest they aroused in that magazine.

Principles of Trade and Industrial Teaching

By R. W. Selvidge and Verne C. Fryklund. Cloth, 419 pages, 5¼ by 7⅞. Price, $2.75. Published by The Manual Arts Press, Peoria, Illinois.

The authors of this book have succeeded in crowding a great deal of helpful material into one volume. The book is designed especially for the prospective teacher. Not only must the teacher analyze what he is to teach to his students, but he must also analyze how he is to teach it. The procedure for doing this forms the basis of the book. The question of testing is well covered in a chapter entitled "Measuring Results," and an appendix gives examples of available achievement tests.

Industrial Arts for Public School Administrators

By Frederick Gordon Bonser. Cloth, 95 pages, 5¼ by 7¾. Price, $1.50. Published by Bureau of Publications, Teachers College, Columbia University, New York City.

This little booklet in readable form, gives a very lucid explanation of what is meant by industrial arts. The purposes of industrial arts in elementary school, junior high school, and senior high school, also are given.

The Art of Pottery

By Irma M. Gall and Vivian M. Van Etta. Cloth, 80 pages, 6⅞ by 9½, illustrated. Price, $1.35. Published by The Bruce Publishing Company, Milwaukee, Wisconsin.

The contents of this book were assembled by the authors in an endeavor to present to junior-high-school students a course of study in the fundamentals of modeling, glazing, and firing ceramic projects. The elementary work consists of the designing and producing of decorative animal forms; geometric animals, birds, and other figures; monograms and name plates, etc. As the student becomes more skilled in handling the materials, he is given such projects as bowls, dishes, boxes, and vases of various kinds.

There is also a lesson on firing and glazing. An appendix containing a table showing the temperatures of pyrometric cones, a list of equipment, a bibliography, and a list of dealers, from whom pottery supplies and equipment may be obtained, is added.

Caminos Viejos

By Terry E. Stephenson. Cloth, 110 pages, 7 by 10, illustrated. This attractive booklet contains tales from the history of California, especially about the vales, the hills, and the canyons of Orange county. It is published by Thomas E. Williams, director of the Santa Ana High School and Junior College, and was printed by the students of that institution.

This admirable piece of work shows what the school printshop can do in the way of preserving the history of a community. It represents a creative job which, because of its initiative and originality, deserves imitation.

The book sells at $5 and a limited edition of 250 volumes were placed on sale. The profits from this endeavor are all diverted to the Student Loan Fund.

A Picture Tour Through Trade Schools and Classes of the United States

Compiled by Laurence Parker. The author of this interesting volume felt that the many fine things done in vocational education throughout the country ought to be better known. He has, therefore, sallied forth with camera and pen to picture and record how individual states take care of the problem of training their citizens to occupy places in industry. The information which accompanies the illustrations is in Mr. Parker's inimitable lucid style.

Problems in Metalwork

By John B. Butler. Cloth, 136 pages, 8 by 10⅞, illustrated. Price, $2.50. Published by The Manual Arts Press, Peoria, Illinois.

(Continued on Page 24a)

This Catalog

Simplifies the Specifying of School Shop Equipment

THE condensed Index for School Use furnished with Stanley Tool Catalog No. 34A is of real assistance in making up tool specifications for the school shop.

The index is separated into sections covering the equipment for each type of school shop. In it are lists of tools for the Elementary and Junior High School Shop, the Senior High School Shop and the Vocational School Shop.

Catalog No. 34A contains description of all Stanley and Stanley-Atha Tools. It presents in one book practically a complete line of woodworking and many metal working tools. Send for an up-to-date copy together with the new School Index.

THE STANLEY RULE & LEVEL PLANT
Educational Department
New Britain, Conn.

STANLEY TOOLS

Stanley Equipment is Standard Equipment

Is This Book a Textbook in Your School?

JUDGING from the large number of requests received, we assume that most of the industrial schools of the country are using the "Handbook for Drillers" to teach the fundamentals of twist drills and drilling practice.

But, we don't want to miss any if we can help it. So, if you've overlooked the "Handbook" up to now, please bear in mind that we're anxious to send you a copy for study, and, thereafter, as many additional copies as you may need to supply your classes.

A brand new "Thirteenth" Edition awaits your order.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND NEW YORK-CHICAGO-LONDON SAN FRANCISCO

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

(Continued from Page 116)

This book contains chapters on the selection of equipment, care and use of tools, methods of construction, methods of developing patterns, shop kinks, and 26 different sheet-metal jobs. The problems are in unit instruction form in which the purpose of the job, material used, tools, and procedure are described. Besides this, each problem is accompanied by a number of questions which must be answered by the student.

News Notes

Enlarge Oswego Normal School

The Normal School at Oswego, N. Y., is to be enlarged and improved, at an expenditure of more than $300,000. The work is to extend over a three-year period, and is in addition to the erection of the industrial-arts building upon which work will be started.

Begin Occupational Survey

The members of the New York City Vocational Survey Commission held a meeting recently to outline the procedure necessary for conducting a survey of occupational opportunities in the city. Attention will be centered upon the problem of discovering the opportunities for employment, and the types and kinds of skill and knowledge which boys and girls must possess in order to engage in them with the greatest promise of rapid advancement and adequate compensation. The findings of the survey will be used to maintain a continuous service which will periodically inform the board of education of changes in vocational needs and of facilities and curriculum changes which should prove practical and effective in keeping abreast of the times.

Classes for Idle Graduates

The school officials of Minneapolis have begun work upon plans for a number of special classes for unemployed high-school graduates. The school board will use a portion of its extension fund to finance the instruction, but a scholarship fund is proposed to take care of carfare and free lunches for needy students. The work will consist of cooking, sewing, and renovation of clothing for girls, and the repair of electrical equipment and furniture, shoe repair, and cooking for boys.

More Vocational Aid for the States

Senator Capper of Kansas has proposed that Congress appropriate $10,000,000 to be distributed over a period of four years for the further development of vocational education among the states. The proposal is included in a bill now before Congress. The fund would be used as a supplement to the Smith-Hughes Law, as follows: $1,000,000 for the fiscal year ending in June, 1930, and for each year thereafter for a term of three years a sum exceeding by $1,000,000 the sum appropriated during the preceding year.

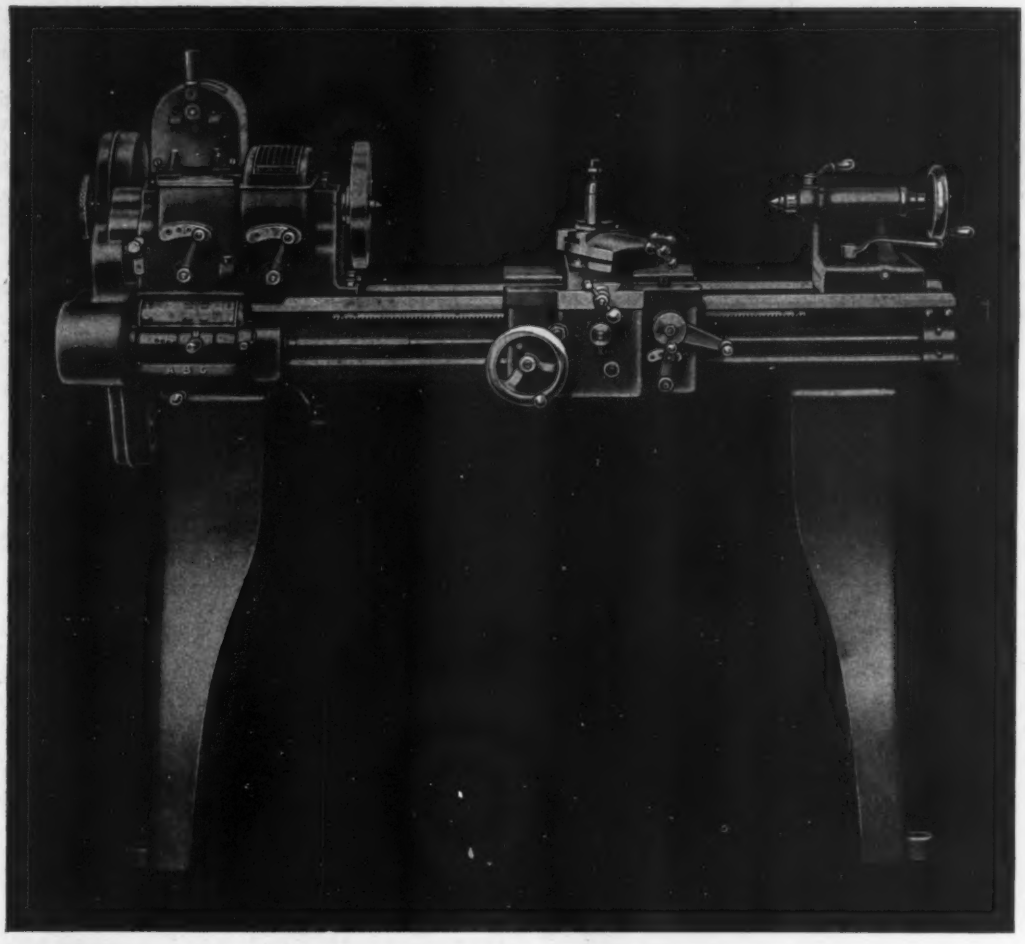
Civil Service Examination

The U. S. Civil Service Commission has announced a competitive examination for the position of research assistant. Applicants will be rated on education, experience, and mental test. The examination is to fill vacancies in the research division and the position carries a salary of $3,200 a year. Full information may be obtained from the U. S. Civil Service Commission, Washington, D. C., or from the secretary of the Civil Service Board of Examiners of any post office in any city.

Casein Glue Methods for Woods

In order to insure strong joints between side-grain surfaces of wood with casein glue, the U. S. Forest Products Labor-

(Continued on Page 26a)



REGAL
BUILT BY LE BLOND

Simple in operation — just shift gears and go. It has an eight-speed selective geared headstock — no hangers or dangerous shifting of belts. Gears are of normalized and heat-treated alloy steel. Long bearing carriage. Deep, wide, heavily-ribbed bed of close-grained nickel steel alloy iron. Self-contained motor drive through multiple V belts. Feed rod permits the lead screw to retain its accuracy in chasing threads. The Regal is built to stand the rough treatment of inexperienced users.

TRAINING

On Adequate and Suitable Tools Is Valuable Indeed

The Regal Lathe has been built to very definite requirements of vocational training.

Consider its modern features—they include the best practices in lathe design. It is a safe, modern, accurate tool. It is controlled easily and reduces physical labor and danger to the operator to a minimum.

Built to the LeBlond standards of excellence, and sold under the LeBlond guarantee, it becomes a valuable tool for purposes of instruction.

Write for complete data on the Regal Line.

The Regal is built in sizes from 10″ to 18″.
Prices range from $398.00 to $1144.00

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, U.S.A.

Johansson

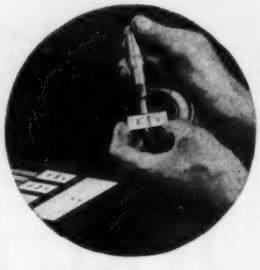
Gage Blocks and Accessories

are priced within the reach of every Mechanic and Manufacturer

Gaging System Set No. 13
consists of 11 blocks and will make 732 different size gages in steps of .010 inch from .010 inch to 7.320 inches. Available in three accuracies.

STANDARDIZATION is the result of using *Johansson Gage Blocks and Accessories.*

The mechanic or manufacturer who uses Johansson Gage Blocks and Accessories to guard dimensions of length on the products manufactured will produce a greater quantity in a shorter period of time, due to their ability to determine accurately the extreme maximum and minimum limits specified, which reduces the cost of production.



Wide limits from specified sizes should be deliberately allowed, not endured, on account of inadequate methods of measuring dimensions of length.

Send maximum and minimum dimensions of length with closest working limits, and we will recommend the Johansson gaging system best suited to your particular gaging problems. Delivery from stock.

Prices and literature on application — order direct or through your mill supply dealer

C. E. JOHANSSON, *Inc., Division of*

FORD MOTOR COMPANY

Detroit, Michigan

(Continued from Page 24a)

atory at Madison, Wis., has classified important American species of woods in two groups, with a suggestive gluing technique for each group. The information which is given in Technical Bulletin No. 205 of the Department of Agriculture, *Gluing Wood in Aircraft Manufacture,* offers suggestive information on gluing conditions for various species of wood. It also offers helpful information for use in occasional weak joints in red gum heartwood, black cherry, and hickory.

Vocational Record Plan Adopted

The school board of Longmont, Colo., has adopted a plan for keeping the vocational record of all pupils. Under the plan, teachers from the fifth grade through the high school will keep a record of the likes and dislikes of pupils. Tendencies which show a pupil's desire for various types of work will be noted. The plan is intended to serve as a guide for pupils in taking up their lifework.

Auto-Mechanics Course at Danville, Va.

A course in auto mechanics is being offered during the second semester at George Washington High School, Danville, Va. The course will consist of a study of the fundamental principles of lighting, ignition, transmission, armature winding, and electrical research problems. A technical survey will be made of various types of gas motors.

Conference on Foreman Training

A foreman training conference was held February 2–14, at Princeton, W. Va., under the direction of Prof. E. S. Maclin, state supervisor of trade and industrial education, assisted by Mr. N. B. Giles, of the Federal Board for Vocational Education.

New Industrial School in Mexico

The Alvaro Obregon School, the largest industrial school in Mexico, was opened recently, with an initial enrollment of 400 students. The school was built by the State of Nuevo Leon, at a cost of $250,000, and is part of a campaign to educate Mexican students in their own country.

Vocational Course at Mt. Gilead, Ohio

New machinery has recently been installed in the junior high school at Mt. Gilead, Ohio, in connection with a shop course to be conducted in the school. Students in the senior high school and seventh and eighth grades will make use of the new equipment. During the second semester, woodworking is being stressed. Later metalwork may be added to the course.

Manual-Training School in New Quarters

The manual-training school at Girard, Ohio, has been moved to its new location on Wilson Avenue. The change releases three rooms for the use of high-school classes.

Course in Aviation in Des Moines

A ground course in aviation for junior and senior students in the East High School has been introduced at Des Moines, Iowa, with the opening of the second semester. The main objective of the course is to deal with the history and development of aerial flight; the fundamental principles underlying design; and the construction and operation of aircraft power plants.

Teachers to Help Vocational Survey in New York

Supt. William J. O'Shea, of New York City, has been authorized to assign a number of teachers to assist the special committee which is conducting a survey of vocational-school facilities and needs of the city.

Vocational Shop at Duluth, Minn.

Construction work will be started shortly on a new vocational shop. The building will provide facilities for auto mechanics and welding work, and will cost $60,000.

Trade Courses for Girls

Trade courses for girls are planned for early inclusion in the course being offered at the State Trade School, Meriden, Conn.

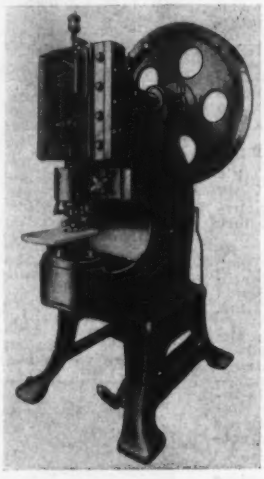
ADVERTISING PAGES REMOVED

School Shop Equipment News

For the Supervisor or Teacher who desires to keep abreast with news of new Machinery, Tools, Supplies, etc.

NEW CAMPBELL NIBBLING MACHINE FOR SHEET-METAL WORK

The Campbell No. 3 Nibbling Machine, just announced by the A. C. Campbell Company, of Bridgeport, Connecticut, is intended for cutting all kinds of shapes from sheet metal up to ¾ in. It is especially useful for cutting original pieces and for production work where expensive punches and dies are required.



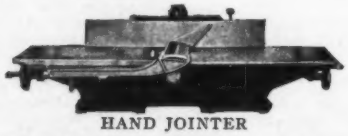
NIBBLING MACHINE

The Campbell nibbling machine cuts rapidly in any direction, without any burr, so that very little finishing is required. The machine is built to handle a large variety of work, including circles and original cuts, is rigidly proportioned, easy to operate, and insures a large amount of safety to the operator. It occupies a floor space 5 ft. by 4 ft. 2 in., has a belt drive of 9,000 pounds, a pulley speed of 105 r.p.m., and is equipped with a 7½-h.p. motor.

Any school-shop instructor can obtain complete descriptive information and prices by writing to the Campbell Company at Bridgeport, Connecticut.

NEW, IMPROVED WALLACE HAND JOINTER

The J. D. Wallace Company, of Chicago, Ill., has announced the marketing of its new No. 10 hand jointer, with safety and cutter-head features.



HAND JOINTER

The jointer which contains new and revolutionary improvements in the form of a skew-knife cutter head, comprises three fundamental improvements, namely, the knives lie flat and are clamped in position with die-cast duralumin cover plates, which receive the bolts and washers. The four bolts, which are made of a fine quality alloy steel, specially treated to produce toughness, are screwed in with a hexagonal socket wrench, which is included with each machine.

The counterhead is mounted on two high-speed Timken taper roller bearings, and the tables are cast of semisteel,

(Continued on Page 34a)

WHAT features do your boys need in a hammer? What will help their unskilled hands do a better job, in less time, with less spoiled work? That's what counts! Not what we think they ought to have.

So Plumb Tool designers get more ideas from users than they do in the factory: Working in school shops with instructors, out on jobs with carpenters and mechanics; making suggestions; getting criticisms; designing tools in the only practical laboratory—that of actual use.

Over a period of years this method has developed many improvements in design . . . changes that have brought Plumb Tools to a high peak of efficiency.

No wonder the expert picks a Plumb Nail Hammer: With its broad face for greater accuracy; with its short neck for better balance; with the sharp bend of its claws which gives powerful leverage; with its vise-like grip that pulls the slimmest headless brad; with its balance that makes it work like a part of his arm; and with that famous Plumb invention which takes up any looseness in the handle, just by a turn of the screw.

Greater usefulness... longer life . . . less cost in the long run: Those are the reasons more and more manual training schools are adopting the Plumb Nail Hammer as standard in school shops. Specify HF81, 1-lb. head. Price $1.50. HF 82, 13. oz. head. Price $1.45.

FAYETTE R. PLUMB, Inc.
Philadelphia, U. S. A.

PLUMB
DOUBLE LIFE
Hammers Hatchets
Files Sledges Axes

The Story of

"PROFESSOR—I've got it!" exclaimed a young man, bursting excitedly into the private laboratory of the head of the chemistry department of an Ohio college, on the morning of February 23, 1886.

Extending his cupped hand, he proudly exhibited to the astonished professor, half a dozen little globules of a silver-colored metal.

It was no wonder he was excited, or that his excitement was shared by the incredulous professor, for at 22 years of age he had achieved what some of the world's greatest scientists had failed to achieve after half a century of application to the same problem. And where they had enjoyed the facilities of great laboratories, with all manner of scientific equipment, and yet had failed, this 22-year-old American youth had worked out the problem in the woodshed in his backyard, with the crudest kind of equipment.

The Discovery

IT all came about as the result of a chance remark made by Frank Fanning Jewett, his chemistry professor at Oberlin College, one morning during the young man's senior year. In talking with the students in his chemistry class Prof. Jewett made the offhand observation that if anyone should invent a process by which aluminum could be made on a commercial scale, he would not only be a benefactor to the world, but he would also be able to lay up for himself a great fortune.

Serious-minded Charles Martin Hall nudged a classmate and whispered, "I'm going for that metal."

Go for it he did, and in dead earnest. Discovering a cheap method of producing aluminum became an obsession with him. Had he known that he was racing with another young man, across the seas, and had he realized how nearly the two would tie each other, he would scarcely have slept during the next year! As it was, he spent much of his spare time outside of school hours in the college laboratory working doggedly on the problem, for he had read somewhere, that every clay bank was potentially a mine of aluminum, and that the metal was as costly as silver.

But all his application, and all his admitted genius, and all his knowledge of chemistry, seemed of no avail against this aluminum riddle. "Going for it" was one thing, but getting it was quite another. All avenues seemed to lead to failure.

It was not until eight months after he had finished college that he started thinking along an entirely new line. If aluminum could not be extracted inexpensively by the chemical processes with which scientists had been struggling for half a century, and with which he had worked unsuccessfully for so many months, might it not be done by electricity?

That was a new idea. It seemed worth investigating.

Hall knew something of electrolysis and he lost no time in fitting up the woodshed behind his father's house on East College Street, Oberlin, as a laboratory. Borrowing an odd assortment of battery jars and plates from the college laboratory, and buying a small crucible, he set them along the edge of the upper floor of the two-story woodshed, so that he could stand while at work on the lower steps and oversee both levels. Then he set up a home-made furnace and bellows.

Days were spent—precious days that were worth hundreds of thousands of dollars to him had he known it—in constructing crude pieces of apparatus that he had not the small means to purchase.

At last, however, everything was ready for an entirely new experiment.

Melting some cryolite in his little clay crucible, and dissolving some "alumina" (refined aluminum ore) in it, he switched on his batteries and passed the electric current through the molten mass for about two hours.

We can imagine with what impatience he paced up and down in the woodshed during those two hours!

Finally the time was up and he poured out the molten mass. Alas! There was no aluminum!

However, he was not discouraged. Indeed, it is said of Charles Martin Hall that he was never discouraged for more than a few hours at a time.

He started to think his way into the problem, and it may be observed in passing that Hall never worked at random nor never stumbled onto things—he thought things through. In this instance, he came to the conclusion that there might be some impurities in his clay crucible and they might be affecting the result.

Promptly he constructed a carbon lining for the crucible and he proceeded to repeat the experiment.

Again he waited impatiently for two hours as the current from his makeshift batteries passed through the molten mass.

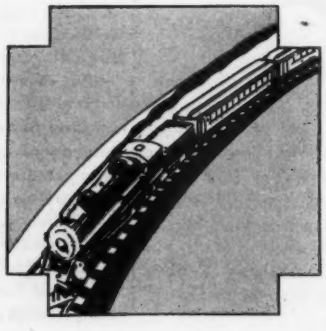
Again he poured out the material, eagerly, hopefully.

Could he believe his eyes? There, in the bottom of the crucible, were a number of small globules of aluminum!

Excitedly he called his sisters and showed them the still hot little "buttons" of aluminum. (Some of these are today carefully preserved in the Pittsburgh offices of Aluminum Company of America.)

As soon as these globules, or "buttons," were cool enough to handle, Hall took them in the palm of his hand and hurried to the college, where he burst in upon Professor Jewett with the startling news with which this story opens—"Professor—I've got it!"

That day—February 23, 1886—marked the birth of a new metal age—The Age of Aluminum!



Two months later to the day (April 23, 1886) a French chemist, Paul L. T. Heroult (by coincidence also 22 years of age) applied for a French patent on the identical process!

Hall had won by a margin of eight weeks!

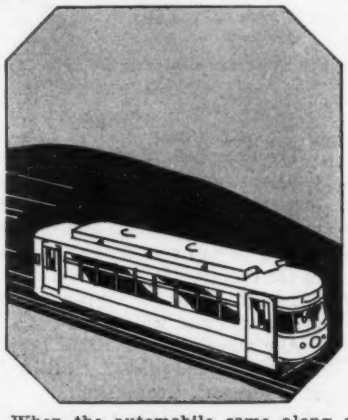
A New Industry Is Born

CURIOUSLY enough, after a company had been organized to produce aluminum by Hall's process, one of the first articles made was a teakettle. But this was not chance. Because it was known that aluminum conducted heat so efficiently, and because it was so easy to keep clean and bright, and because it promised to wear forever, Hall and his backers saw that it was an ideal metal for cooking utensils. Thus it was that aluminum got its first big start in the kitchen.

Everybody knows how aluminum cooking utensils took America by storm, and how much they have lightened the drudgery of housework and added to the cleanliness and cheerfulness of our kitchens and the wholesomeness of our meals.

But the usefulness of aluminum was not to be confined to the kitchen. It was destined to invade hundreds of industries and to be used for thousands of purposes.

For example, because of its light weight and excellent electrical conductivity, it began to be used to make cable (with a core of steel wire for greater strength) for conveying electrical current across country. Thousands of miles of aluminum power lines are to be seen today.



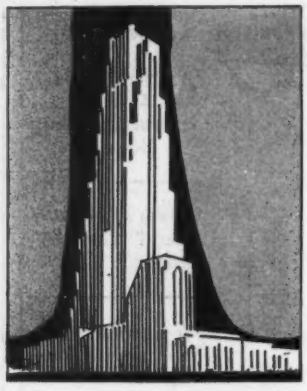
When the automobile came along a dozen new uses were found for this light metal which automotive engineers found saved weight and made possible speedier cars. Pistons and connecting rods of aluminum alloys became almost standard in automobile engineering practice. Today, eight out of ten motor car manufacturers use aluminum alloy pistons in their motors.

Close on the heels of the automobile came the airplane, and here aluminum figured from the first as an essential metal. It is the cheapest metal that is light, and at the same time strong enough, to stand the stresses and strains of air navigation.

However, these modern miracles of metallurgy were not accomplished with the quality of aluminum which Hall had made in his woodshed laboratory. When aluminum began to be used for industrial purposes, it was found that for some uses it lacked the necessary strength. A research laboratory was established and presently, by combining aluminum with small percentages of other metals, a series of "alloys" was developed. After these alloys had been heat treated they became exceedingly tough and strong—some of them as strong as structural steel.

Aluminum

READ IT TO YOUR STUDENTS — Inspirational — Tells How a Typical American Boy Achieved Fame and Riches.



These alloys contain 95 per cent or more of aluminum, so they preserve all the characteristic lightness and bright color of the parent metal, but they are many times as strong and are now used for the heaviest kind of duty. For example, the bodies of some of the armored motor cars seen on our city streets, are made of strong aluminum alloys. Could any but a stout metal be used for such a purpose?

When railroad and street car companies began to face the necessity of lighter cars and locomotives, so that their trains and trolleys might run on faster schedules to meet the demand for greater speed in transportation, they turned naturally to these strong alloys of aluminum. Roofs, frames and side walls of passenger cars made of rolled sheets and structural shapes of strong aluminum alloys. Drop-forged aluminum driving-rods for connecting the huge driving-wheels of powerful steam locomotives are already beginning to be used, and the time seems not far distant when aluminum will play a big part in speeding up our train and trolley service all over the country, at the same time reducing operating costs for the transportation companies.

From year to year, many other interesting discoveries were made about aluminum. It was found that this bright metal could be ground to a flaky powder and made into paint. At first this flaky powder was mixed with banana oil and used almost exclusively for painting radiators.

But soon paint makers found that it could be mixed with varnish, like any other paint pigment. When this aluminum paint is applied, the minute flakes of metal overlap one another (as revealed by microscopic examination), and form a tough and flexible metallic coat that defies rain, sun, snow or hail.

This was an important discovery, for while people may not want aluminum-colored houses, it has been demonstrated that aluminum paint as a priming coat forms a thin film of metal that protects the wood underneath against moisture changes, and makes the color coats that are put on top wear much longer. Eventually, it is thought, the best grades of lumber may come already "primed" with aluminum paint.

Another interesting discovery was that aluminum could be rolled into foil—some of it so thin that it would take ten sheets to equal the thickness of the paper on which this story is printed!

Because this foil is pure and clean and will not tarnish, and because it is impervious to light or moisture or gases, the manufacturers of food and drug products soon discovered it to be ideal for wrapping their products. Foods may be kept in contact with it indefinitely with perfect safety.

Today aluminum foil is used for wrapping and protecting a wide variety of products—chocolate bars, candy mints, chewing gum, yeast cakes, cheese, tea, film rolls, soap, cigars and cigarettes, to mention a few.

Aluminum is also used for screw caps for jars of vanishing cream, bottles of lotions, and many food and drug products. Aluminum caps (often in color and bearing printed trademarks or designs) are used for sealing bottles of ketchup, pickles, salad dressing, etc., and for capping bottles of proprietary remedies.

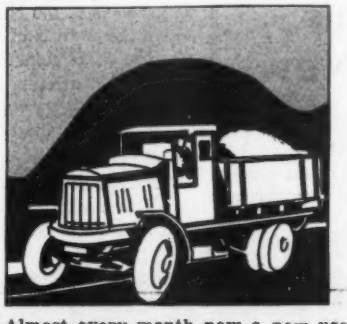
Perhaps more interesting still, soft aluminum is made into collapsible tubes for tooth paste, shaving cream and numerous pharmaceutical products.

How little did Charles Martin Hall dream what a contribution he was making to the comfort of life on that February morning when he rushed out of his woodshed laboratory with a few globules of aluminum in his hand and started for Prof. Jewett's laboratory to break the news of his success!

And the end is not yet.

As the skyscrapers in our great cities have pushed their towers higher and higher, the problem of weight has become more and more important. Much metal is used for decorative purposes—for cornices, spandrels, window frames, leaders and gutters, and the like. This has opened up a whole new field for this metal that is only one-third as heavy as the older structural metals, will not rust, tarnish or discolor, and can be rolled or cast or worked into any desired form.

Many modern offices are furnished with aluminum chairs, either left in their natural bright finish or finished to resemble mahogany or walnut. And in many hospitals and sanitariums and railroad dining cars, aluminum chairs are used because they can be lifted so easily and they will stand all sorts of abuse. Col. Lindbergh's "flying office" is equipped with aluminum furniture.



Almost every month now a new use is found for aluminum in some of its forms or alloys. The business that started in an Oberlin, Ohio, woodshed now spreads out over the map of America from Niagara Falls to Bauxite, Arkansas; and from Edgewater, New Jersey, to Oakland, California. In addition to mines, it operates great ore reduction plants, power plants, foundries, rolling mills, tube mills, wire mills, and a variety of fabricating plants, employing nearly 25,000 men and women.

And the Aluminum Age is only in its dawn stage!

The Threshold of a New Age

All this is amazing, when you stop to think that, until Charles Martin Hall discovered how to produce aluminum electrolytically in 1886, this metal which now plays so large a part in our lives, was so expensive that it was regarded almost as a semi-precious metal! Indeed, within the memory of some who will read this story, aluminum sold for $25.00 a pound, whereas it now sells for less than 25 cents a pound, thanks to this Oberlin, Ohio, school-boy—and to the activities of the scientists and engineers of Aluminum Company of America. Imagine being able to buy a $25.00 rug or a $25.00 chair for less than 25 cents!

Of course, Hall's original process has been greatly improved, in the forty-odd years that the research engineers of the aluminum industry have been working on this almost magical metal. Hall himself would be amazed at some of the properties of the aluminum that is now being made, and at the enormous plants producing great aluminum castings and beams and forgings, side by side with airplane propellers, automobile parts, paint pigment, aluminum cable, and tissue-thin foil.

You are probably curious to know whether Hall realized a fortune from his discovery. So few inventors do.

Well, Hall did. When he died in 1914, he was the largest stockholder in the Company and left an estate worth several millions. And the fine thing about it was that he left his stock in the Company to educational and philanthropic causes. One-half was left to Oberlin and another American college, one-sixth to education in the near east and the remainder to philanthropic organizations.

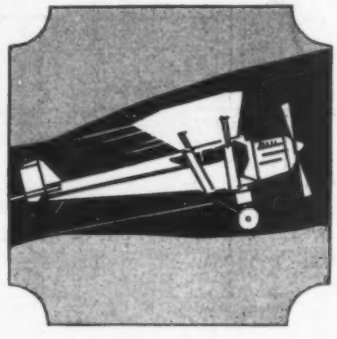
But his greatest legacy was an industry which serves us all, making our work easier and our lives more cheerful and comfortable.

Aluminum Company of America is not the only factor in this fast-growing American industry. It is the largest single factor, and the sole producer of the virgin metal in this country. But there are a number of other important companies making aluminum castings, sheet aluminum for fabrication purposes, and aluminum products of many kinds. Furthermore, considerable foreign-made aluminum is imported.

In order to establish the identity of its own brands, and to build good-will around its name, Aluminum Company of America has created a trade name. That name is made up of three syllables, AL CO A, standing for the beginning letters of the principal words of its name: AL uminum CO mpany **of** A merica.

ALCOA ALUMINUM is the highest standard in the world.

To all modern developments aluminum is making an important contribution. To some it is absolutely essential. That is why, as we face the future in America, we find ourselves only just crossing the threshold of this wonderful new age—The Aluminum Age!



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Association and Convention News

THE WESTERN ARTS CONVENTION

The Western Arts Association will hold its annual meeting April 28 to May 1, at Louisville, Ky. Both the meetings and exhibits will be housed in the Brown Hotel. Arrangements have been made for a number of interesting side trips.

On the opening day, Tuesday, April 28, there will be registration of members, inspection of school exhibits and visits to schools of the city. Mr. R. E. Daugherty, of Louisville, will give the address of welcome.

The local committee on arrangements is working hard to make this meeting the most successful ever held.

OSWEGO NORMAL BOYS' CLUB MEETING

The Oswego Normal Boys' Club will hold their twenty-first annual dinner at the Mens' Faculty Club, Columbia University, New York City, on March 7.

This club, which was formed in 1900, is one of the oldest of its kind in the country. Each year a dinner and meeting is

(Continued on Page 34a)

MEMBERS OF THE MANUAL ARTS CONFERENCE OF THE MISSISSIPPI VALLEY STATES, WHO ATTENDED THE 21ST ANNUAL SESSION, AT OHIO STATE UNIVERSITY, COLUMBUS, OHIO, DECEMBER 18, 19, 20, 1930

From left to right: A. B. Mays, University of Illinois, Urbana; L. F. Ashley, S. T. C., Charleston, Illinois; W. G. Wilson, Chicago Normal College; O. E. Sink, S. T. C., Muncie, Indiana; G. A. Willoughby, S. T. C., Ypsilanti, Michigan; E. C. Weaver, S. T. C., Kalamazoo, Michigan; F. C. Whitcomb, Miami University, Oxford, Ohio; W. T. Bawden, Industrial Education Magazine; J. J. Metz, Industrial Arts and Vocational Education; G. E. McLaughlin, Ohio University, Athens; A. C. Newell, I. S. N. U., Normal, Illinois; Thomas Diamond, University of Michigan, Ann Arbor; D. J. Crowley, S. T. C., Bowling Green, Ohio; W. E. Roberts, Board of Education, Cleveland; M. L. Laubach, S. T. C., Terre Haute, Indiana; E. P. Rinehart, Marietta, Ohio; G. U. Cleeton, Carnegie Institute, Pittsburgh; H. T. Wilhite, S. T. C., Muncie, Indiana; A. F. Siepert, Bradley Institute, Peoria, Illinois; W. H. Stone, Ohio State University, Columbus; G. B. Cox, State College, Corvallis, Oregon; R. L. Schwanzle, S. T. C., Emporia, Kansas; G. K. Wells, State Department of Education, Indianapolis, Indiana; L. V. Newkirk, State University, Iowa City; M. E. Franklin, S. T. C., Tahlequah, Oklahoma; DeWitt Hunt, State A. & M. College, Stillwater, Oklahoma; N. B. Grinstead, S. T. C., Warrensburg, Missouri; C. R. Lindstrom, S. T. C., Peru, Nebraska; C. A. Bennett, Industrial Education Magazine; M. J. Sherwood, S. T. C., Kalamazoo, Michigan; R. W. Sharp, S. T. C., Florence, Alabama; C. S. Van Deuzen, S. T. C., Kent, Ohio; L. T. Smith, S. T. C., Bowling Green, Kentucky; R. W. Selvidge, University of Missouri, Columbia: E. W. Bollinger, University of North Dakota, Grand Forks; B. N. Osburn, Sioux City, Iowa; Delbert Schwartz, Marietta, Ohio.

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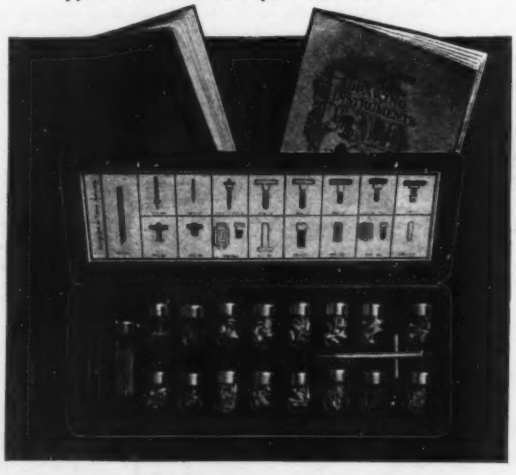

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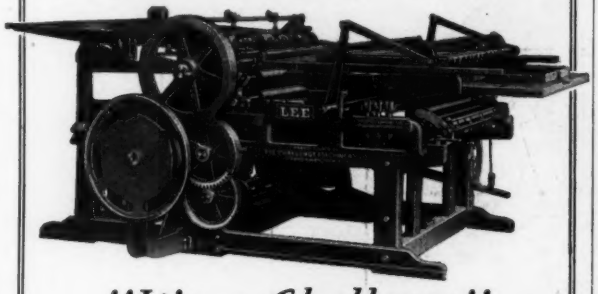

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(Continued from Page 29a)

thus making it possible to omit expensive steel lips which are otherwise required to prevent the table from being nicked and chipped.

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THE TRAVELERS GUARD

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(Continued from Page 32a)

held in New York City. The membership of the club consists of teachers of industrial arts in and around the metropolitan area within a radius of 200 miles.

This year the club anticipates an attendance of 100 persons. The speakers at the meeting will be Dr. N. H. Dearborn, of New York Universtiy; Dr. James Riggs, principal of Oswego Normal School; Mr. J. C. Park, head of the industrial-arts department of the Oswego Normal School. Graduates of the Normal School are invited to attend the meeting.

MICHIGAN INDUSTRIAL-EDUCATION SOCIETY

The annual meeting of the Michigan Industrial-Education Society will be held March 19, 20, and 21 at the Book-Cadillac Hotel, Detroit, Mich. Mr. A. C. Tagg, president of the society, promises to provide an exceptionally strong program.

SCHOOL CRAFTS CLUB ELECTS

The School Crafts Club of New York City, at its annual meeting elected Mr. L. Omer Asher, supervisor of industrial arts at Orange, N. J., as its president. Mr. Asher is a grad-

(Continued on Page 36a)

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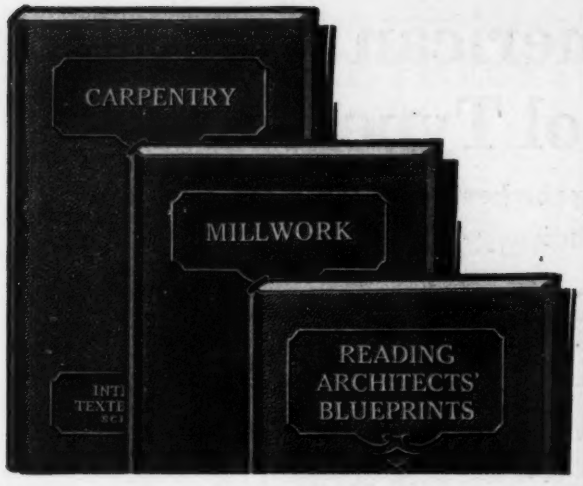

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(Continued from Page 34a)

uate of the Indiana State Normal School, Teachers College, New York, and Rutgers University. He has taught in the public schools of Altoona, Pa., and Rahway, N. J.

L. OMER ASHER
Supervisor of Industrial Arts
Orange, New Jersey

At the November meeting of the club, Mr. Asher recalled briefly the work of his predecessors in office, who, as he said, upheld the objectives and traditions of the club and thus assisted in solving the problems which confront industrial and vocational teachers.

The meetings of the past year have been notable for their fine programs. At the November meeting, 35 members listened to an illustrated talk by Mr. R. H. McFadden, technical representative of the National Lead Company, on the process of making white lead.

On January 17, Miss Leonard, director of the School of Soap Sculpture of New York, gave a demonstrative talk on soap sculpture. Mr. J. S. Mendenhall, who followed Miss Leonard, described the work of the Junior Achievement Society, an organization which functions throughout the metropolitan area and which teaches boys and girls business and economic principles through actual work. The meeting closed with two round-table discussions which were led by members.— *Arnold M. Hess.*